

# **TECHNICAL PROVISIONS**

## **VOLUME I OF II**

### **TERMINAL BUILDING EXPANSION**

**BID NO. PUR – 1436**

**FAA AIP. 3-24-0019-059-2018 (DESIGN)**

**MAA-GR-19-009 (DESIGN)**



### **HAGERSTOWN REGIONAL AIRPORT – RICHARD A. HENSON FIELD HAGERSTOWN, MD**

*Prepared For:*

### **THE BOARD OF COUNTY COMMISSIONERS OF WASHINGTON COUNTY MARYLAND**

*Prepared By:*



**AIRPORT DESIGN CONSULTANTS INC  
6031 UNIVERSITY BLVD SUITE 330  
ELLCOTT CITY, MD 21043**

**JULY 2019**

### **BID DOCUMENTS**

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**BID NO. PUR-1436**  
**AIP 3-24-0019-059-2018 (DESIGN); MAA-GR-19-009 (DESIGN)**  
**INVITATION TO BID**  
**ISSUED ON BEHALF OF**  
**THE BOARD OF COUNTY COMMISSIONERS**  
**OF WASHINGTON COUNTY, MARYLAND**  
**BY**  
**THE WASHINGTON COUNTY PURCHASING DEPARTMENT**  
**100 WEST WASHINGTON STREET, ROOM 320**  
**HAGERSTOWN, MD 21740-4748**  
**PHONE: 240-313-2330 / FAX: 240-313-2331**

**DATE ISSUED: July 2019**

**HAGERSTOWN REGIONAL AIRPORT TERMINAL BUILDING EXPANSION**

**PRE-BID CONFERENCE DATE/  
TIME AND LOCATION:**

**Wednesday, July 24, 2019 at 1:30 P.M., (EST)**  
Hagerstown Regional Airport  
Terminal Conference Room  
18434 Showalter Road  
Hagerstown, MD 21742

**DEADLINE FOR QUESTIONS:**

No later than **4:00 P.M. (EST), Wednesday July 31, 2019**

**SUBMIT BIDS TO:**

Washington County Purchasing Department  
Washington County Administration Complex  
100 West Washington Street  
Third Floor, Room 3200  
Hagerstown, MD 21740-4748

**BID SUBMISSION DEADLINE  
AND BID OPENING TIME:**

No later than **2:00 P.M., (EST), Wednesday, August 7, 2019**

**BID OPENING LOCATION:**

Washington County Administration Complex  
Conference Room 2001  
Second Floor, 100 West Washington Street  
Hagerstown, MD 21740-4748

If indicated below (✓) and not waived by the County, Bidders shall be required to provide the following:

✓ A Bid Bond, in the amount of five (5%) percent of the bid on a bid of \$100,000 or more for construction contracts. See "Bid Bonds – Section 2" of the General Conditions and Instructions to Bidders.

✓ A Performance Bond for a bid award of \$100,000 or more on construction contracts. See "Bid Bonds – Section 2" of the General Conditions and Instructions to Bidders.

✓ A Labor and Material Bond for a bid award of \$100,000 or more on construction contracts. See "Bid Bonds – Section 2" of the General Conditions and Instructions to Bidders.

**BID DOCUMENTS**



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**PURCHASING DEPARTMENT  
DIVISION OF BUDGET & FINANCE**

100 West Washington Street, Room 320 | Hagerstown, MD 21740-4748 | P: 240.313.2330 |  
F: 240.313.2331  
[www.washco-md.net](http://www.washco-md.net)

**PUR-1436  
INVITATION TO BID  
TERMINAL BUILDING EXPANSION  
AT HAGERSTOWN REGIONAL AIRPORT – RICHARD A. HENSON FIELD  
AIP 3-24-0019-059-2018 (DESIGN); MAA-GR-19-009 (DESIGN)**

The Board of County Commissioners of Washington County, Maryland will accept sealed bids for the Terminal Building Expansion at Hagerstown Regional Airport – Richard A. Henson Field. Bid documents are available immediately from the Washington County website: [www.washco-md.net](http://www.washco-md.net) by accessing the “Quick Links/Open Bid Invitations – Purchasing Department” or may be obtained in the Washington County Purchasing Department, Washington County Administration Complex, 100 West Washington Street, Third Floor, Room 3200, Hagerstown, MD 21740-4748. Inquiries should be directed to the undersigned at 240-313-2330. **Direct all inquiries to Rick Curry, CPPO, Director of Purchasing at telephone 240-313-2330 or fax 240-313-2331.**

All bids must be enclosed in a sealed opaque envelope marked “**SEALED BID – Terminal Building Expansion at Hagerstown Regional Airport – Richard A. Henson Field**” and be received and time stamped by the Washington County Purchasing Department, Washington County Administration Complex, 100 West Washington Street, Third Floor, Room 3200, Hagerstown, Maryland, 21740-4748, no later than **2:00 P.M., local time, (EST) on Wednesday, August 7, 2019** after which time they will be publicly opened in Conference Room 2001. All interested parties are invited to be present.

A Pre-Bid Conference will be held on **Wednesday, July 24, 2019 at 1:30 P.M. (EST)** in the Hagerstown Regional Airport Conference Room, 18434 Showalter Road, Hagerstown, Maryland. All interested bidders are requested to be present. Attendance is not mandatory but is strongly encouraged.

**NOTE: All Proposers/Bidders must enter the Washington County Administrative Complex through either the front door at the 100 West Washington Street entrance or through the rear entrance (w/blue canopy roof) which is handicap accessible and must use the elevator**

to access the Purchasing Department to submit their proposal and/or to attend the Pre-Proposal Conference. Alternate routes are controlled by a door access system. Washington County Government has announced new security protocols being implemented at the Washington County Administrative Complex at 100 West Washington Street, Hagerstown. The new measures took effect Tuesday, February 14, 2017. The general public will be subject to wand search and will be required to remove any unauthorized items from the building prior to entry. Prohibited items include, but are not limited to: Weapons of any type; Firearms, ammunition and explosive devices; Cutting instruments of any type - including knives, scissors, box cutters, work tools, knitting needles, or anything with a cutting edge, etc.; Pepper spray, mace or any other chemical defense sprays; and Illegal substances.

Washington County shall make positive efforts to utilize Disadvantaged Business Enterprises for its supplies and services and shall allow these sources to maximum feasible opportunity to compete for contracts. The Board of County Commissioners does not discriminate on the basis of race, color, national origin, sex, religion, age and disability in employment or the provision of services. Individuals requiring special accommodations are requested to contact the undersigned at 240-313-2330 Voice, TTY Dial 711 to make arrangements no later than five (5) calendar days prior to the Pre-Bid Conference and/or Bid Opening.

**Funding for the Terminal Building Expansion is anticipated through the Federal Aviation Administration (FAA) Airport Improvement Program (AIP). FAA required contract provisions include, but are not limited to the following provisions referenced here: Buy American Preference, Civil Rights – Title VI Assurances, Davis Bacon Requirements, Debarment and Suspension, Disadvantaged Business Enterprise, Foreign Trade Restriction, Lobbying Federal Employees and Recovered Materials.**

The Board of County Commissioners of Washington County, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 USC §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders or offerors that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

For Contracts that exceed \$10,000, the Affirmative Action Requirements are as follows:

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

#### **Timetables**

Goals for minority participation for entire project: 9.72%

Goals for female participation in entire project: 6.9%

These goals are applicable to all of the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the Contractor also is subject to the goals for both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a) and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs (OFCCP) within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this notice and in the contract resulting from this solicitation, the "covered area" is Maryland, Washington County, Hagerstown.

The Board of County Commissioners of Washington County, Maryland, reserves the right to accept or reject any or all bids and to waive formalities, informalities and technicalities therein. The Board reserves the right to contact a Bidder for clarifications and may, at its sole discretion, allow a Bidder to correct any and all formalities, informalities and technicalities in the best interest of Washington County.

By Authority of:



Rick Curry, CPPO  
Director of Purchasing

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**TERMINAL BUILDING EXPANSION  
HAGERSTOWN REGIONAL AIRPORT-RICHARD A. HENSON FIELD  
AIP 3-24-0019-059-2018 (DESIGN); MAA-GR-19-009 (DESIGN)**

**BID NO. PUR-1436  
BID DOCUMENTS  
JULY 2019**

## **SECTION 1 BID DOCUMENTS**

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**BOARD OF COUNTY COMMISSIONERS**  
**OF WASHINGTON COUNTY, MARYLAND**

**GENERAL CONDITIONS AND INSTRUCTIONS TO BIDDERS**

**INTRODUCTION**

The general rules and conditions which follow, along with all other documents consisting of this "Bid Document," apply to all purchases and become a definite part of each formal invitation to bid, purchase order, contract, or other award issued by the Washington County's Director of Purchasing (hereinafter "Director of Purchasing"), unless otherwise specified. Bidders or their authorized representatives are expected to fully inform themselves as to the conditions, requirements, and specifications before submitting bids; failure to do so will be at the Bidder's own risk and they cannot secure relief on the plea of error. Bidders are advised that all costs related to preparing and/or submitting a Bid or Proposal shall be borne by the Bidder.

Satisfactory evidence of authority to bind the firm by the person signing the Bid when submitted by partnerships or corporations may be requested by the County prior to making any award. Anyone signing a Bid as an agent shall include evidence of his/her authority to do so.

Subject to Maryland State and Washington County, Maryland (hereinafter "County") laws and all rules, regulations and limitations imposed by legislation of the Federal Government, bids on all advertisements and invitations issued by the Washington County Purchasing Department shall bind bidders to applicable conditions and requirements set forth herein unless otherwise specified in the Invitation to Bid. Should there be a conflict in laws between states, State of Maryland law shall prevail.

*Should there be a conflict between the general bid conditions and the supplemental bid conditions (if any), the supplemental bid conditions shall prevail.*

**GENERAL CONDITIONS OF BIDDING**

1. **Bids Binding for One Hundred and Twenty (120) Days:** Unless otherwise specified all formal bids submitted shall be binding for one hundred and twenty (120) calendar days following bid opening date, unless the bidder, upon request of the Director of Purchasing, agrees to an extension.
2. **Bids for All or Part:** Unless otherwise specified by the County or by the Bidder, the County reserves the right to make award on all items, or on any of the items according to the best interests of the County. Bidder may restrict his/her bid to consideration in the aggregate by so stating but should name a unit price on each item bid upon; any bid in which the bidder names a total price for all the articles without quoting a price on each and every separate item, may be rejected at the option of the County.
3. **Catalogs:** Each Bidder shall submit where necessary or when requested by the Director of Purchasing, catalogs, descriptive literature, and detailed drawings, fully detailing features, designs,

construction, finishes and the like necessary to fully describe the materials or work they propose to furnish.

4. **Collusive Bidding:** The Bidder certifies that his/her bid is made without any previous understanding, agreement or connection with any person firm, or corporation making a bid for the same project, without unlawful prior knowledge of competitive prices, and is in all respects fair, without outside control, collusion, fraud or otherwise illegal action.
5. **Competency of Bidder:** No proposal shall be accepted from or contract awarded to any person, firm or corporation that is in arrears or is in default to Washington County upon any debt or contract, or that is a defaulter, as surety or otherwise, upon any obligation to said County, or had failed to perform faithfully any previous contract with the County. The Bidder, if requested, must present within forty-eight (48) hours evidence satisfactory to the Director of Purchasing of performance ability and possession of necessary facilities, pecuniary resources and adequate insurance to comply with the terms of these specifications and contract documents.

The successful Bidder shall actively cooperate in all matters pertaining to the proper compliance of this contract and shall come to the office of the Director of Purchasing whenever requested in connection with the performance of this contract.

The successful Bidder shall inform the Director of Purchasing of any and all circumstances which may impede the progress of the work or inhibit the performance of the contract including, but not limited to: bankruptcy, dissolution or liquidation, merger, sale of business, assignment, etc.

The County may examine the Bidder's and any first-tier subcontractor's records to determine and verify compliance with the contract. The Bidder and any first-tier subcontractor must grant the County access to these records at all reasonable times during the contract term and for three (3) years after final payment. If the contract is supported to any extent by Federal or State funds, the appropriate Federal or State authorities may also examine these records. The Bidder must include the preceding language of this paragraph in all first-time subcontracts.

6. **Completeness:** All information required by Invitation to Bid must be supplied to constitute a proper bid. The County shall not be responsible for the premature opening of Bids if not properly addressed or identified.
7. **Conditional Bids:** Qualified bids are subject to rejection in whole or in part.
8. **Confidentiality:** Firms shall give specific attention to the identification of those portions of their proposals that they deem to be confidential, proprietary information or trade secrets and provide any justification why such materials, upon request, should not be disclosed by the County under the Access to Public Records Act, State Government Article, Title 10, Sections 10-611 to 10-628, Annotated Code of Maryland.
9. **Errors in Bids:** When an error is made in extending total prices, the written unit bid price shall govern. In the absence of written prices, the unit bid price shall govern. Carelessness in quoting

prices, or in preparation of bid, otherwise, will not relieve the Bidder. *Erasures or changes in bids must be initialed.*

**10. General Guaranty:** Bidder agrees to:

- a. Save the County, its agents and employees harmless from liability of any nature or kind for the use of any copyrighted or uncopyrighted composition, secret process, patented or unpatented, invention, article or appliance furnished or used in the performance of the contract which the Bidder is not the patentee, assignee, licensee or owner.
- b. Protect the County against latent defective material or workmanship and to repair or replace any damages or marring occasioned in transit or delivery.
- c. Furnish adequate protection against damage to all work and to repair damages of any kind, to the building or equipment, to their own work or to the work of other contractors, for which their worker is responsible due to the negligence in the course and scope of the employment.
- d. Pay for all permits, licenses and fees and give all notices and comply with all laws, ordinances, rules and regulations of the County and State of Maryland.

**11. Illegal Immigrants:**

- a. The Bidder shall comply with the Immigration and Nationality Act (INA) which includes provisions addressing employment eligibility, employment verification, and nondiscrimination. Under the INA, the Bidder may hire only persons who may legally work in the United States (i.e., citizens and nationals of the U.S.) and aliens authorized to work in the U.S. The Bidder shall verify the identity and employment eligibility of anyone employed or to be employed, including completion of the Employment Eligibility Verification Form (I-9). The Bidder shall establish appropriate procedures and controls to insure that no services under this Contract will be performed by any worker who is not legally eligible to perform such services or for employment.
- b. Failure by the Bidder or his/her Sub-Contractors to comply with the provisions of Section 11.a. herein will be grounds for termination of the Contract.

**12. Insurance:** Liability insurance on all major divisions of coverage for each and every Bidder and subcontractor shall be required for the length of the contract. Bidder and subcontractor must supply evidence of insurance upon request. Each Bidder agrees to assist in every manner possible in the reporting and investigation of any accident, and upon request, agrees to cooperate with all interested insurance carriers in the handling of any claims by securing and giving evidence and obtaining the attendance of witnesses as required for any claim or suit. The Bidder shall be prepared to show evidence of insurance as required under Washington County's *Insurance Requirements for Independent Contractors Policy*, included herein, prior to the execution of any contract. The Bidder, if requested, shall provide the Certificate of Insurance to the Purchasing Department within ten (10) calendar days after receiving a request for it. Failure to provide an

acceptable Certificate of Insurance within the time frame stated above shall be cause to terminate the contract(s). The certificate shall state that such insurance is in force and cannot be cancelled or released except upon thirty (30) days prior written notice to the County. If any of the stated coverages expire during the term of this contract, the Bidder shall deliver renewal certificates to the County at least ten (10) calendar days prior to the expiration.

- 13. Interpretations, Discrepancies, Omissions:** Should any Bidder find discrepancies in, or omissions from the documents or be in doubt of their meaning, he/she should at once request, in writing, an interpretation from:

Rick Curry, CPPO – Director of Purchasing  
Washington County Purchasing Department  
Washington County Administration Complex  
100 West Washington Street, Room 3200  
Hagerstown, MD 21740-4748  
FAX: 240-313-2331 or send questions in Microsoft Word platform via  
e-mail to: [purchasingquestions@washco-md.net](mailto:purchasingquestions@washco-md.net)

All necessary interpretations will be issued to all Bidders in the form of addenda to the specifications, and such addenda shall become part of the contract documents. Exceptions as taken in no way obligates the County to change the specifications. Failure of any Bidder to receive any such addendum or interpretation shall not relieve such Bidder from any obligation under his/her bid as submitted. The County shall assume no responsibility for oral instructions or suggestions. ORAL ANSWERS WILL NOT BE BINDING ON THE COUNTY. Requests received after 4:00 P.M. on the date included in the Supplemental Terms and Conditions may not be considered.

- 14. Landfill Tipping Fees:** Disposal of items shall be at an approved sanitary landfill and any fees for same must be included in the Bidder's proposal.
- 15. Late Bids:** Formal bids or amendments thereto received by the County after the time specified for bid opening will not be considered. Bids received after the time specified for bid opening will be returned unopened.
- 16. Mailing of Bids:** The County assumes no responsibility for the timely deliverance of mailed bids. Ample time should be allowed for the transmittal of bids by mail, and postmarks indicating the date of mailing will not be considered as evidence of intent to submit bids in proper time for the opening.
- 17. Maryland Buy American Steel Act:** In accordance with the Annotated Code of Maryland -State Finance and Procurement Article, Sections 17-301 – 17-306, Washington County is defined as a Public Body and as such shall require a Bidder or subcontractor to use or supply only American Steel products in the performance of a contract as stated in the above referenced Sections.
- 18. Multiple Bids:** No Bidder shall be allowed to offer more than one (1) price on each item even though he/she may feel that there are two (2) or more types or styles that will meet specifications. Bidders must determine for themselves which to offer. If said Bidder should submit more than

one (1) price on any item, all prices for that item may be rejected at the discretion of the Director of Purchasing.

19. **Officers Not to Benefit:** No member of the elected governing body of Washington County, or members of his or her immediate family, including spouse, parents, or children, or any person representing, or purporting to represent any member or members of the elected governing body shall receive or be promised directly or indirectly, any financial benefit, by way of fee, political contribution, or any other similar form of remuneration and/or on the account of awarding and/or executing the contract and that upon request of the County, as a prerequisite to payment pursuant to the terms of this contract, there will be furnished to the requester, under oath, answers to any interrogatories related to a possible conflict of interest as herein embodied. The Bidder, to the best of his/her knowledge, whether he/she be an officer, director, partner or any of its employees directly involved in obtaining contracts with the State, or any County or other subdivision of the State, has not been convicted of bribery or conspiracy to bribe under the laws of any State or Federal Government. Any contract made or entered into where it is discovered that violation of the intent of this provision exists shall be declared null and void and all monies received by the Bidder shall be returned to the County.
20. **Payment Terms:** Bid prices are to be net thirty (30) calendar days; all discounts are to be deducted and reflected in net prices. Term discounts of less than twenty (20) calendar days will not be considered in connection with any prompt payment discount offered, time will be computed from date of receipt of correct invoice or receipt and acceptance of shipment, whichever is later.
21. **Procurement Policy Manual:** This bid is administered according to Washington County's Procurement Policy Manual adopted by the Board of County Commissioners of Washington County, Maryland on June 25, 2013 and effective July 1, 2013. The contents of the aforementioned Manual may be requested from the Washington County Purchasing Department at 240-313-2330 or may be found on the web site at:  
<https://www.washco-md.net/wp-content/uploads/2017/07/ProcurementPolicy.pdf>.
22. **Proposal Forms:** Bids shall be submitted only on the forms provided by the County. The Bidder shall submit one (1) original bid on the forms provided with original signature, sealed to the County for that purpose. All bids must be enclosed in a sealed, opaque envelope marked with the title of the bid and be received in the Washington County Purchasing Department promptly on or before, time, date, and place stipulated on the Invitation to Bid. **NO** bids received after such stipulated time and date will be considered by the County. ***Facsimile Bids will not be accepted.***
23. **Registration with Maryland Department of Assessments and Taxation:** Prior to contracting, private corporations must either be incorporated in the State of Maryland or registered with the Maryland Department of Assessments and Taxation as a foreign corporation and must be in good standing. Proof of such standing is required prior to the start of the contracting process and good standing shall be maintained for the duration of the contract. The website for the State Department of Assessments and Taxation is: <http://dat.maryland.gov/Pages/sdatforms.aspx#BNE>, email address is [sdat.charterhelp@maryland.gov](mailto:sdat.charterhelp@maryland.gov), and phone numbers are: (410) 767-1340 or (888) 246-5941.

- 24. Reservations:** The County or its authorized agent reserves the right to reject any or all bids and to waive any informality or deficiency in bids received whenever such rejection or waiver is in the best interest of the County. The County also reserves the right to reject the bid of a Bidder who has previously failed to perform properly or complete on time contracts of a similar nature, or the Bid of a Bidder who investigation shows is not in a position to perform the contract. The County reserves the right to waive minor differences in specifications provided these differences do not violate the specifications intent nor affect the operation for which the items are being purchased, nor increase estimated maintenance and repair cost to the County. The County reserves the right to award contracts or place orders on a lump sum or individual item basis, or such combination as shall, in its judgment, be in the best interest of the County.
- 25. Response to Invitation:** In the event you cannot submit a bid on our requirements, as set forth in the "Invitation to Bid", please return the Bid with an explanation as to why you are unable to bid on these requirements. Because of the large number of firms listed on the County's lists of Bidders, it is necessary to delete from these lists the names of those persons, firms or corporations who fail to respond after having been invited to bid on a commodity or commodities for three (3) successive bid openings.
- 26. Substitutions:** All equipment is to be supplied in exact accordance with the specifications. Any Bidder who contemplates offering a product that differs from that specified must obtain the County's written approval prior to bid opening. Substitution requests must be received in the Purchasing Department no later than the date/time specified in the Supplemental Terms and Conditions. Requests received after the specified date/time will not be considered. All such decisions will be considered final and not subject to further recourse.
- 27. Taxes-Responsibility for Payment, Exemptions, Forms to be Filed, etc.:**
- a. The County is exempt from State of Maryland Sales Tax. The County's Maryland Sales Tax Exemption Number is 3000129 2. However, the Bidder is responsible for making any necessary inquiries and investigations with regulating state agencies to obtain a determination of tax exemptions in his/her bid.
  - b. The Bidder is responsible for and by submitting a Bid agrees to pay all retail sales, income, real estate, sales and use, transportation and special taxes applicable to and assessable against any materials, equipment, processes and operations incident to or involved in the Project. The Bidder is responsible for ascertaining and acquainting his/herself with such taxes and making all necessary arrangements to pay same.
  - c. The Successful Bidder shall complete a W-9 Vendor Information form (provided by the County) and return it to the Director of Purchasing.
  - d. The County hereby reserves the right to withhold payment under this Contract until the Bidder and any subcontractor performing any duties under this Contract have furnished or caused to be furnished to the Comptroller of the State of Maryland with all properly completed forms required by the said Comptroller and until all of said retail sales and/or

use taxes due the State of Maryland by the Bidder have been paid and the Bidder exhibits a release or receipt from the Comptroller evidencing such payment.

- e. The Bidder is hereby advised of Section 1-106(b)(3) of the Code of Public Local Laws of Washington County, MD: "If a bidder has not paid all taxes owed to the County or a municipal corporation in the County, the County Commissioners may reject the bidder's bid."

28. **Withdrawal of Bids:** A written request for the withdrawal of a bid or any part thereof may be granted if the request is received by the County prior to the specified time of opening.

### BID BONDS

1. **Bid Deposit - Bid Bond, Certified or Cashier's Check:** Each bid shall be accompanied by a bid bond signed by a surety company licensed to do business in the State of Maryland, or by a cashier's check, certified check or Treasurer's check drawn on a responsible bank doing business in the United States in the amount of five (5%) percent of the total Bid and shall be made payable to the Board of County Commissioners of Washington County, Maryland. When computing the amount of Bid for Check purposes, DO NOT deduct for trade-ins. U.S. Postal Money Orders are acceptable in lieu of checks.
2. **Performance/Labor and Material Bonds:** The successful Bidder(s) on this bid must furnish the required bonds as indicated at the beginning of the Specifications, made out to the Board of County Commissioners of Washington County, Maryland, prepared on forms contained herein, or in his/her absence, on an approved form, as security for the faithful performance of his/her contract, within fifteen (15) calendar days of his/her notification that his/her bid has been accepted. The surety thereon must be such surety company or companies as are authorized and licensed to transact business in the State of Maryland. Attorneys in fact who sign bonds must file with each bond a certified copy of his/her power of attorney to sign bonds. The successful Bidder or Bidders upon failure or refusal to furnish within fifteen (15) calendar days after his/her notification the required bonds shall forfeit to the County, as liquidated damages his/her bid deposit. The Performance Bond shall be in the amount of one hundred (100%) percent of the contract price covering faithful performance of the contract; and the Labor and Materials Payment Bond shall be in the amount of one hundred (100%) percent of the contract price as security for payment of all persons performing labor and furnishing materials in connection therewith.

### SPECIFICATIONS REFERENCES

1. **Formal Specifications:** The Bidder shall abide by and comply with the true intent of the specifications and not take advantage of any unintentional error or omission but shall fully complete every part as the true intent and meaning of the specifications and drawings. Whenever mention is made herein, of any article, material, or workmanship to be in accordance with laws, ordinances, building codes, underwriter's codes, A.S.T.M. regulations or similar expressions, the requirements of these laws, ordinances, etc., shall be construed to meet or exceed specification

requirements and current established noise levels for specific equipment, materials, and/or services being furnished under this contract.

2. **Samples:** The Purchasing Department reserves the right to retain or destroy the samples submitted for the purpose of evaluation and will be free from any redress or claim on the part of the Bidder if any samples are lost or destroyed. Bidders shall make all arrangements for delivery of samples to the place designated, as well as the removal of samples. Cost of delivery and removal of samples shall be borne by the Bidder. Upon notification by the Purchasing Department that a sample is available for pickup, it shall be removed within thirty (30) calendar days at the Bidder's expense or the Director of Purchasing shall dispose of same at his/her discretion. All sample packages shall be marked "Sample for Purchasing Department" and each sample shall bear the name of the Bidder, item number, bid number, and shall be carefully tagged or marked in a substantial manner. Failure of the Bidder to clearly identify samples as indicated may be considered sufficient reason for rejection of bid.
3. **Trade Names/Substitutions:** In cases where an item is identified by a manufacturer's name, trade name, catalog number, or reference it is understood that the Bidder proposes to furnish the item so identified and does not propose to furnish an "equal/substitution" unless submission of an "equal/substitution" is stated otherwise as permissible. Any Bidder who contemplates offering a product that differs from that specified must obtain the County's written approval by submission of his/her request no later than the deadline for receipt of substitution requests as stated in the Supplemental Terms and Conditions. The reference to the above catalog is intended to be descriptive but not restrictive and only to indicate to the prospective Bidder articles that will be satisfactory. Bids on makes and catalogs will be considered, provided each Bidder clearly states on the face of his/her proposal exactly what he/she proposes to furnish, and forwards with his/her bid, a cut, illustration, or other descriptive matter which will clearly indicate the character of the article covered by his/her bid. The Director of Purchasing hereby reserves the right to approve as an equal, or to reject as not being an equal, any article the Bidder proposes to furnish which contains major or minor variations from specification requirements but may comply substantially therewith. If no particular brand, model, or make is specified, and if no data are required to be submitted with the bid, and after award and before manufacture or shipment, the successful Bidder may be required to submit working drawings or detailed descriptive data sufficient to enable the Director of Purchasing to judge if each requirement of the specifications is being complied with.

## AWARD

1. **Award or Rejection of Bids:** For contracts of purchase, the contract shall be awarded to the lowest, responsive and responsible Bidder complying with all the provisions of the Invitation, provided the bid price is reasonable and it is to the best interest of the County to accept it. For contracts of sale, the contract shall be awarded to the highest, responsive and responsible Bidder complying with all the provisions of the Invitation, provided the bid price is to the best interest of the County to accept it.
2. **Notice of Award:** A written award (or Acceptance of Bid) mailed (or otherwise furnished) to the successful Bidder within the time for acceptance as specified herein shall be deemed to result in a



binding contract without further action by either party. The bid with respect to all items accepted and all papers accompanying the same, the general conditions and instructions to Bidders, the specifications, and other papers and documents referred to in any of the foregoing shall constitute the formal contract, unless otherwise specified, between the Bidder and the County.

3. **Political Contribution Disclosure:** In accordance with Maryland Code, State Finance and Procurement Article, §17-402, the Bidder shall comply with Maryland Code, Election Law Article, Title 14, which requires that every person that enters into contracts, leases, or other agreements with the State, a county, or any incorporated municipality, or their agencies during a calendar year in which the person receives in the aggregate \$100,000 or more, shall file with the State Administrative Board of Election Laws a statement disclosing contributions in excess of \$500 made during the reporting period to a candidate for elective office in any primary or general election. The statement shall be filed with the State Administrative Board of Election Laws: (1) before a purchase or execution of a lease or contract by the State, a county, an incorporated municipality or their agencies, and shall cover the preceding two (2) calendar years; and (2) if the contribution is made after the execution of a lease or contract, then twice a year, throughout the contract term, on: (a) February 5, to cover the 6-month period ending January 31; and (b) August 5, to cover the 6-month period ending July 31.
4. **“Requirements” Contract Bid Quantities:** On “Requirements” bids, acceptance shall bind the County to pay for, at unit bid prices, only quantities ordered and satisfactorily delivered. All stated quantities are estimated requirements and do not constitute a minimum or maximum.
5. **Responsibility/Qualifications of Bidder:** The County may make such investigations as it deems necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the County all such information and data for this purpose as the County may request. The County reserves the right to reject any bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the County that such Bidder is properly qualified to carry out the obligation of the contract and to complete the work contemplated therein. Conditional bids will not be accepted. In determining responsibility, the following qualifications, in addition to price, shall be considered by the Director of Purchasing on contracts of purchase and on contracts of sale (if applicable):
  - a. The ability, capacity and skill of the Bidder to perform the service required.
  - b. The character, integrity, reputation, judgment, experience and efficiency of the Bidder.
  - c. The quality of performance of previous contracts or services.
  - d. The Bidder’s previous and present compliance with laws and ordinances relating to the contract or service.
  - e. The sufficiency of the financial resources and ability of the Bidder to perform the contract or provide the service.
  - f. The quality, availability and adaptability of the supplies, or services, to the particular use required.

- g. The ability of the Bidder to provide future maintenance and service for the use of the subject of the contract.
- h. Whether the Bidder is in arrears to the County on a debt or contract or is a defaulter on surety to the County.
- i. Such other information as may be secured having a bearing on the decision to make the award.

In determining a Bidder's responsiveness, the Director of Purchasing shall consider material deviations from the advertised specifications which materially affect price, quantity, quality or limit the Bidder's liability.

- 6. **Specific Bid Quantities:** Where quantities are specifically stated, acceptance will bind the County to order quantities specified and to pay for, at contract prices, all such supplies or services delivered that meet specifications and conditions of the contract. However, the County will not be required to accept delivery of any balances unordered, as of the contract expiration date; unless Bidder furnishes the Director of Purchasing with a statement of unordered balances not later than ten (10) calendar days after the termination date of the contract.
- 7. **Tie Bids:** If two (2) or more Bidders shall be tied for the lowest bid on a purchase contract, quality and service being equal, the contract shall be awarded to a local Bidder. If there is no local Bidder, or more than one local Bidder, the County shall award the contract to one (1) of the Bidders by drawing lots in public.

### CONTRACT PROVISIONS

- 1. **Availability of Funds:** A contract shall be deemed executory only to the extent of appropriations available to each County department/agency for the purchase of such articles. The County's extended obligation on those contracts that envision extended funding through successive fiscal periods shall be contingent upon actual appropriations for the succeeding fiscal year.
- 2. **Contract Alterations:** No alterations or variables in the terms of a contract shall be valid or binding upon the County unless made in writing and signed by the County or its authorized agent.
- 3. **Default:** The contract may be cancelled or annulled by the County in whole or in part by written notice of default to the Bidder upon non-performance or violation of contract terms. An award may be made to the next low Bidder, or, articles specified may be purchased on the open market similar to those so terminated. In either event, the defaulting Bidder (or their surety) shall be liable to the County for costs to the County in excess of the defaulted contract prices: Provided, that the Bidder shall continue the performance of this contract to the extent not terminated under the provisions of this clause. Failure of the Bidder to deliver materials or services within the time stipulated on his/her bid, unless extended in writing by the Director of Purchasing, shall constitute contract default. In the event that a Bidder exempted from posting a Bid or Performance Guarantee

fails to execute and perform any contract awarded to them, they shall forfeit the right to Bid on any future County contract for a period of time determined by the Director of Purchasing and they shall be liable for any costs incurred by the County as a result of his/her default.

4. **Guarantee:** All work, supplies, and/or materials and requirements described in the specifications including any modifications thereto which may be made in accordance with the direction and/or approval of the County Director of Purchasing shall be Guaranteed/Warranted for a period of one (1) year from the date of final acceptance by the County as follows, unless indicated otherwise in this contract:
- a. Against all faulty or imperfect materials and/or equipment and against all imperfect, careless and/or unskilled workmanship.
  - b. Against injury or undue deterioration from proper and usual use of the goods and/or services.
  - c. Removal and replacement with proper materials, equipment, and/or services and re-execute, correct or repair without cost to the County, any materials, equipment, and/or services found to be improper, imperfect, defective or fails to perform as specified.
  - d. Make good all damage caused to other work, materials and/or equipment due to such required removal, replacement and/or re-execution.
  - e. Shall comply with any and all guarantee/warranties of whatever nature referred to in other portions of the contract specifications.

Any warranties whether expressed or implied shall not reduce the risk of the seller's/manufacturer's obligation to the County against latent defect which may be found during the rated life of the supplies and/or materials and requirements described in the specifications including any approved modifications.

5. **Intergovernmental Purchasing:** The following Agencies/Jurisdictions shall be able to purchase, if applicable, directly from contracts resulting from this Invitation to Bid (ITB): Washington County Board of Education and all of its public schools, Hagerstown Community College, Municipalities of Washington County, and public or quasi-public agencies that receive County money and are exempt from taxation under Section 501(c)(3) of the Internal Revenue Code, i.e., Washington County Volunteer Fire and Rescue Companies. While this ITB is prepared on behalf of the County, it is intended to apply for the benefit of the above-named agencies/jurisdictions as though they were expressly named throughout the document. Each of these agencies/ jurisdictions may purchase from the successful Bidder under the same terms and conditions of the contract with the County, in accordance with each agencies/jurisdictions respective laws and regulations, or an agency may choose not to procure from the successful Bidder at the agency's sole discretion. If one of the above-named agencies/jurisdictions elects to purchase under the contract, the price shall be determined by using unit costs and other pertinent costs provided in the offer. Any special discounts unique to a particular agency/jurisdiction shall be stated. Bidder shall also submit the attached "Provisions for Other Agencies" form, if included in this bid.

6. **New Goods, Fresh Stock:** All contracts, unless otherwise specifically stated, shall produce new commodities, fresh stock, latest model, design or pack.
7. **Non-Discrimination:** No Bidder who is the recipient of County funds or who proposes to perform any work or furnish any goods under this agreement shall discriminate against any worker, employee or applicant or any member of the public because of religion, race, sex, color or national origin, age, marital status, physical or mental handicap, nor otherwise commit an unfair employment practice. Bidder further agrees that this article will be incorporated by Bidder in all contracts entered into with suppliers of materials or services, Bidders and subcontractors and all labor organizations, furnishing skilled, unskilled and craft union skilled labor, or who may perform any such labor or services in connection with this contract.
8. **Non-Liability:** The Bidder shall not be liable in damages for delay in shipment or failure to deliver when such delay or failure is the result of fire, flood, strike, act of God, act of government, act of an alien enemy or by any other circumstances which, in the Director of Purchasing's opinion, is beyond the control of the Bidder. Under the circumstances, however, the County may in its discretion, cancel the contract.
9. **Placing of Orders:** Orders against contracts shall be placed with the Bidder on a Purchase Order executed and released by the Director of Purchasing.
10. **Subletting of Contract:** It is mutually understood and agreed that the Bidder shall not assign, transfer, convey, sublet, or otherwise dispose of their contract or their rights, title or interest therein, or their power to execute such contract, to any other person, firm or corporation, without the previous written consent of the County Director of Purchasing, but in no case shall such consent relieve the Bidder from his/her obligations, or change the terms of the contract.
11. **Termination of Contracts:** Contracts shall remain in force for full periods specified and until all articles ordered before date of termination shall have been satisfactorily delivered and accepted and thereafter until all requirements and conditions shall have been met, unless:
  - a. Terminated prior to expiration date by satisfactory deliveries of entire contract requirements.
  - b. Extended upon written authorization of the Director of Purchasing and accepted by Bidder, to permit ordering of unordered balances or additional quantities at contract prices and in accordance with contract terms.
12. **Termination for Convenience:** The performance of work under this Contract may be terminated by the County in accordance with this clause in whole, or from time to time in part, whenever the County shall determine that such termination is in the best interest of the County. The County shall pay all reasonable expenses associated with this Contract that the Contractor has incurred up to the date of termination, and all reasonable expenses associated with termination of the Contract; provided, however, the Contractor shall not be reimbursed for any anticipatory profits that have not been earned up to the date of termination.

## DELIVERY PROVISIONS

1. **Delivery:** Delivery shall be required to the place designated in the specifications or on the proposal form. All prices must be FOB Destination, Inside Delivery. The weight, count, measure, etc. shall be determined at the points of delivery. The Bidder shall be required to furnish proof of delivery in every instance. Bulk materials are to be placed on skids or pallets. No help for unloading shall be provided by the County. Suppliers shall notify their shippers accordingly.
2. **Delivery Failures:** Failure of a Bidder to deliver within the time specified, or within a reasonable time as interpreted by the Director of Purchasing or failure to make replacements of rejected articles when so requested, immediately or as directed by the Director of Purchasing shall constitute authority for the Director of Purchasing to purchase in the open market articles of comparable grade to replace the articles rejected or not delivered. On all such purchases, the Bidder shall reimburse the County, within a reasonable time specified by the Director of Purchasing, for any expense incurred in excess of contract prices or the County may deduct such amount from monies owed the defaulting Bidder. Such purchases shall be deducted from contract quantities.
3. **Inspections:** Inspection and acceptance of materials or supplies shall be made after delivery. Final inspection shall be conclusive except as regards latent defects, fraud, or such gross mistakes as amount to fraud. Final inspection and acceptance or rejection of the materials or supplies shall be made as promptly as practicable, but failure to inspect and accept or reject materials or supplies shall not impose liability on the County for such materials or supplies as are not in accordance with the specifications. All delivered materials shall be accepted subject to inspection and physical count.
4. **Hazardous Safety Data Sheets:** Any hazardous substances as defined under the Department of Labor Occupational Safety and Health Standard for General Industry (29-CFR-1910.1200) and State of Maryland Law and Regulations on "Access to Information About Hazardous and Toxic Substances", MDSH Article 89, Section 28-49-D, being delivered to Washington County as a result of this Invitation to Bid shall be accompanied by a current "Hazardous Data Safety Sheet" or item may not be accepted.
5. **Packing Slips or Delivery Tickets:** All shipments or deliveries shall be accompanied by Packing Slips or Delivery Tickets and shall contain the following information for each item delivered. Bidders are cautioned that failure to comply with these conditions shall be considered sufficient reason for refusal to accept the goods.

The Purchase Order Number  
The Name of the Article and Stock Number (Supplier's)  
The Quantity Ordered  
The Quantity Back Ordered  
The Name of the Contractor

6. **Responsibility for Materials Shipped:** The Bidder shall be responsible for the materials or supplies covered by this contract until they are delivered at the designated point and the Bidder shall bear all risk on rejected materials or supplies after notice of rejection. Rejected materials or supplies must be removed by and at the expense of the Bidder promptly after notification of rejection, unless public health and safety require immediate destruction or other disposal of rejected delivery. Upon failure of the Bidder to remove materials or supplies within ten (10) calendar days after date of notification, the County may return the rejected materials or supplies to the Bidder at the Bidder's risk and expense or dispose of them as its own property.
7. **Testing:** The cost of testing a representative sample of an order or shipment for acceptance shall be borne by the County. However, if the order and shipment is rejected for failure to meet the requirements of the specifications or purchase description, the cost of testing shall be charged to the Bidder.
8. **Time of Delivery:** Deliveries shall be accepted between 8:00 A.M. and 3:00 P.M. on weekdays only, unless stated otherwise in the bid document. No deliveries shall be accepted on Saturdays, Sundays or County Holidays, unless otherwise arranged by an individual Department/Agency.

## **SUPPLEMENTAL TERMS AND CONDITIONS**

**Form of Proposal:** All bids must be submitted in duplicate on the forms provided

**Insurance Requirements:** The contractor shall be prepared to show evidence of insurance as required under Washington County's *Insurance Requirements for Independent Contractors Policy*, a copy of which is included herein, prior to the execution of the Contract.

**Interpretations, Discrepancies, Omissions:** Refer to General Conditions and Instructions to Bidders – General Conditions of Bidding, Section 13; no requests received **after 4:00 P.M. on Wednesday, July 31, 2019** shall be considered. All correspondence in regard to this bid shall be directed to and issued by the Washington County Purchasing Department. **Direct all inquiries to the County Director of Purchasing, Rick Curry, telephone 240-313-2330.**

**Pre-Bid Conference:** Attendance at the Pre-Bid Conference on Wednesday, **July 24, 2019 at 1:30 P.M.** in the Hagerstown Regional Airport Conference Room, 18434 Showalter Road, Hagerstown, Maryland is requested. Attendance is not mandatory but is strongly encouraged. Bidders wishing to visit the site will be given the opportunity to do so with the Owner's Representative immediately following the Pre-Bid Conference.

**Substitutions:** Substitution requests shall be received in the Purchasing Department no later than 4:00P.M. (local time), July 31, 2019. All such decisions will be considered final and not subject to further recourse.

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## WASHINGTON COUNTY'S *INSURANCE REQUIREMENTS FOR INDEPENDENT CONTRACTORS*

**POLICY TITLE:** Insurance Requirements for Independent Contractors

**ADOPTION DATE:** August 29, 1989

**EFFECTIVE DATE:** September 1, 1989

**FILING INSTRUCTIONS:** \_\_\_\_\_

### **I. PURPOSE**

To protect Washington County against liability, loss or expense due to damaged property, injury to or death of any person or persons and for care and loss of services arising in any way, out of, or in connection with or resulting from the work or service performed on behalf of Washington County.

### **II. ACTION**

The following should be inserted in all Independent Contractor Contracts:

"The Contractor shall procure and maintain at his sole expense and until final acceptance of the work by the County, insurance as hereinafter enumerated in policies written by insurance companies admitted in the State of Maryland, have A.M. Best rating of A- or better or its equivalent, and acceptable to the County."

1. **Workers Compensation:** The Contractor agrees to comply with Workers Compensation laws of the State of Maryland and to maintain a Workers Compensation and Employers Liability Policy.

Minimum Limits Required:

Workers Compensation - Statutory

Employers' Liability - \$100,000 (Each Accident)

\$500,000 (Disease - Policy Limit)

\$100,000 (Disease - Each Employee)

2. **Comprehensive General Liability Insurance:** The Contractor shall provide Comprehensive General Liability including Products and Completed Operations.

Minimum Limits Required:

Five Million Dollars (\$5,000,000) combined single limit for Bodily Injury and Property Damage.

Such insurance shall protect the County, its agents, elected and appointed officials, commission members and employees, and name Washington County on the policy as additional insured against liability, loss or expense due to damaged property (including loss of use), injury to or death of any person or persons and for care and loss of services arising in any way, out of, or in connection with or resulting from the work of service performed on behalf of Washington County.

The Contractor is ultimately responsible that Subcontractors, if subcontracting is authorized, procure and maintain at their sole expense and until final acceptance of the work by the County, insurance as hereinafter enumerated in policies written by insurance companies admitted in the State of Maryland, have A.M. Best rating of A- or better or its equivalent, and acceptable to the County.

3. **Business Automobile Liability:** The Contractor shall provide Business Auto Liability including coverage for all leased, owned, non-owned and hired vehicles.

Minimum Limits Required:

Five Million Dollars (\$5,000,000) combined single limit for Bodily Injury or Property Damage.

**Certificate(s) of Insurance:** The Contractor shall provide certificates of insurance requiring a 30-day notice of cancellation to the Insurance Department, Board of County Commissioners of Washington County prior to the start of the applicable project.

Approval of the insurance by the County shall not in any way relieve or decrease the liability of the Contractor. It is expressly understood that the County does not in any way represent that the specified limits of liability or coverage or policy forms are sufficient or adequate to protect the interest or liabilities of the Contractor.

All responsibility for payment of any sums resulting from any deductible provisions, corridor, or self-insured retention conditions of the policy or policies shall remain with the Contractor.

**General Indemnity:** The Contractor shall indemnify, defend and save harmless the Board of County Commissioners of Washington County, its appointed or elected officials, commission members, employees and agents for any and all suits, legal actions, administrative proceedings, claims, demands, damages, liabilities, interest, attorneys fees, costs and expenses of whatsoever kind of nature, whether arising before or after final acceptance and in any manner directly or indirectly caused, occasioned or contributed to in whole or in part by reason of any act, error or omission, fault or negligence whether active or passive by the Contractor, or any one acting under its direction, control or on its behalf in connection with or incident to its performance of the Contract.

Revision Date:	August 27, 1991
Effective Date:	August 27, 1991
Revision Date:	March 4, 1997
Effective Date:	March 4, 1997

## PROVISIONS FOR OTHER AGENCIES

### BOARD OF COUNTY COMMISSIONERS OF WASHINGTON COUNTY, MARYLAND WASHINGTON COUNTY PURCHASING DEPARTMENT

#### PROVISIONS FOR OTHER AGENCIES

All items, conditions and pricing shall be made available to the entities listed below if authorized by the Bidder. Authorization is to be indicated by a check mark in the appropriate column. A negative reply will not adversely affect consideration of the bid. Any jurisdiction using this contract shall place its own order with the successful Bidder(s). There is no obligation on the lead jurisdiction for agreements made with other jurisdictions.

<u>YES</u>	<u>NO</u>	<u>JURISDICTION</u>
_____	_____	WASHINGTON COUNTY PUBLIC SCHOOLS
_____	_____	WASHINGTON COUNTY HEALTH DEPARTMENT
_____	_____	OTHER WASHINGTON COUNTY MUNICIPALITIES
_____	_____	HAGERSTOWN COMMUNITY COLLEGE
_____	_____	CITY OF HAGERSTOWN
_____	_____	FREDERICK COUNTY COMMISSIONERS
_____	_____	OTHER FREDERICK COUNTY MUNICIPALITIES
_____	_____	ALLEGANY COUNTY COMMISSIONERS
_____	_____	BOARD OF EDUCATION OF ALLEGANY COUNTY
_____	_____	OTHER ALLEGANY COUNTY MUNICIPALITIES
_____	_____	ALLEGANY COMMUNITY COLLEGE
_____	_____	CITY OF FROSTBURG
_____	_____	CITY OF CUMBERLAND
_____	_____	GARRETT COUNTY - GENERAL SERVICES
_____	_____	BOARD OF EDUCATION OF GARRETT COUNTY
_____	_____	OTHER GARRETT COUNTY MUNICIPALITIES
_____	_____	GARRETT COUNTY COMMUNITY COLLEGE
_____	_____	WASHINGTON COUNTY VOLUNTEER FIRE & RESCUE COMPANIES

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Bidder's Name

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"General Decision Number: MD20190036 06/28/2019

Superseded General Decision Number: MD20180050

State: Maryland

Construction Type: Building

County: Washington County in Maryland.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.60 for calendar year 2019 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.60 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2019. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at [www.dol.gov/whd/govcontracts](http://www.dol.gov/whd/govcontracts).

Modification Number	Publication Date
0	01/04/2019
1	03/08/2019
2	04/05/2019
3	04/12/2019
4	05/03/2019
5	05/10/2019
6	05/24/2019
7	06/14/2019
8	06/28/2019

\* ASBE0024-007 04/01/2019

Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR.....\$ 36.53	16.42+a

Includes the application of all insulating materials, protective coverings, coatings and finishes to all types of mechanical systems

a. PAID HOLIDAYS: New Year's Day, Martin Luther King Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, the day after Thanksgiving and Christmas Day provided the employee works the regular work day before and after the paid holiday.

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BRMD0001-001 04/28/2019

Rates                      Fringes

BRICKLAYER	\$ 32.00	11.56
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CARP0340-001 04/01/2010

Washington County east to Anne Arundel County, Maryland

Rates                      Fringes

CARPENTER (Acoustical Ceiling Installation, Drywall Hanging and Form Work Only)	\$ 24.84	10.65
MILLWRIGHT	\$ 27.91	10.90

-----  
ELEC0307-010 06/01/2019

Rates              Fringes

ELECTRICIAN	\$ 33.90	17.74
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ENGI0037-025 04/01/2017

Rates              Fringes

POWER EQUIPMENT OPERATOR:		
Backhoe, Excavator, Paver	\$ 28.93	12.85+a
Crane	\$ 30.99	12.85+a

a. PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day.

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IRON0568-016 05/01/2018

Northern Washington County

Rates Fringes

IRONWORKER, STRUCTURAL AND REINFORCING	\$ 27.06	20.61
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IRON0568-017 05/01/2018

Southern Washington County

Rates Fringes

IRONWORKER, STRUCTURAL AND REINFORCING	\$ 28.56	20.61
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LABO0616-013 05/01/2019

Rates Fringes

LABORER: Blaster, Demolition	\$ 21.19	20.15
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LABORER: Mason Tender (Brick, Cement/Concrete)	\$ 21.19	20.15
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PAIN0051-004 06/01/2018

Rates Fringes

Glaziers

Glazing Contracts \$2 million and under	\$ 26.07	12.15
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Glazing Contracts over \$2 million	\$ 30.31	12.15
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PAIN0051-017 06/01/2018

Rates Fringes

PAINTER (Brush, Roller, Drywall Finisher/Taper)	\$ 25.06	9.76
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PLAS0039-009 07/01/2010

Rates Fringes

CEMENT MASON/CONCRETE FINISHER	\$ 25.23	10.95
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PLUM0486-020 12/16/2018

All areas East of Hancock, Maryland

Rates Fringes

PIPEFITTER (Including HVAC Pipe and System Installation)	\$ 40.10	19.89
PLUMBER	\$ 40.10	19.89

-----  
PLUM0489-007 11/01/2018

All areas west of Hancock, Maryland

	Rates	Fringes
PIPEFITTER (Including HVAC Pipe and System Installation)	\$ 32.38	15.03
PLUMBER	\$ 32.38	15.03

-----  
SFMD0669-001 04/01/2018

Rates      Fringes

SPRINKLER FITTER (Fire Sprinklers)	\$ 35.60	20.24
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SHEE0100-022 05/01/2019

Rates      Fringes

SHEET METAL WORKER (Including HVAC Duct Installation)		
0-41 miles from City Hall, Cumberland, Maryland	\$ 25.24	22.17
41-65 miles from City Hall, Cumberland, Maryland	\$ 26.24	22.17
66+ miles from City Hall, Cumberland, Maryland	\$ 27.24	22.17

-----  
TEAM0453-005 05/01/2019

Rates      Fringes

TRUCK DRIVER: Dump Truck		
10 to 15 yard capacity	\$ 22.92	21.18
9 to 10 yard capacity	\$ 22.67	21.18
Over 15 yard capacity	\$ 23.27	21.18
Under 5 yard capacity	\$ 22.39	21.18
TRUCK DRIVER: Tractor Haul Truck	\$ 23.27	21.18

-----  
SUMD2010-084 04/30/2010

Rates      Fringes

CARPENTER, All other work	19.66	3.17
IRONWORKER, ORNAMENTAL	\$ 23.80	11.63



LABORER: Common or General	\$ 12.83	1.99
LABORER: Grade Checker	\$ 16.00	2.90
LABORER: Landscape	\$ 10.00	0.00
LABORER: Mason Tender – Stone	\$ 14.03	0.00
LABORER: Mortar Mixer	\$ 16.61	9.08
LABORER: Pipelayer	\$ 15.18	5.58
OPERATOR: Asphalt Roller	\$ 21.35	5.38
OPERATOR: Bobcat/Skid Steer/Skid Loader	\$ 18.63	8.78
OPERATOR: Boom	\$ 21.44	8.29
OPERATOR: Bulldozer	\$ 18.89	8.60
OPERATOR: Forklift	\$ 17.08	2.69
OPERATOR: Gradall	\$ 20.50	8.74
OPERATOR: Grader/Blade	\$ 16.75	5.79
OPERATOR: Loader	\$ 19.32	7.68
OPERATOR: Roller excluding Asphalt	\$ 18.60	8.10
PAINTER: Spray	\$ 21.71	6.77
ROOFER	\$ 20.30	4.70
SHEET METAL WORKER (Metal Roofs Installation)	\$ 20.71	6.23
TILE FINISHER	\$ 17.32	0.00
TILE SETTER	\$ 21.38	4.65

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at [www.dol.gov/whd/govcontracts](http://www.dol.gov/whd/govcontracts).

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

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The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

#### Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey.

Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

#### Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

#### Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

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### WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations.

Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7).

Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board).

Write to:

Administrative Review Board  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

## SIGNATURE TO BIDS

**NOTE: Bidders shall use this page as a cover page when submitting his/her bid.**

Each bid must show the full business address and telephone number of the Bidder and be signed by the person legally authorized to sign contracts. All correspondence concerning the bid and contract, including notice of award, copy of contract and purchase order, will be mailed or delivered to the address shown on the bid in the absence of written instructions from the Bidder to the contrary. Bids by partnerships must be signed in the partnership name by one of the members of the partnership or by an authorized representative, followed by the signature and designation of the person signing, who shall also state the names of the individuals composing the partnership. Bids by corporations must be signed with the name of the corporation, followed by the signature and designation of the officer having authority to sign. When requested, satisfactory evidence of authority of the officer signing in behalf of the corporation shall be furnished. Anyone signing the bid as agent shall file satisfactory evidence of his/her authority to do so.

All documents, materials, or data developed as a result of this contract are the County's property. The County has the right to use and reproduce any documents, materials, and data, including confidential information, used in or developed as a result of this contract. The County may use this information for its own purposes or use it for reporting to Federal agencies. The Bidder warrants that it has title to or right of use of all documents, materials, or data used or developed in connection with this contract. The Bidder must keep confidential all documents, materials, and data prepared or developed by the Bidder or supplied by the County. All erasures and/or changes shall be initialed by the individual making modifications to the proposal.

BIDDER MUST SIGN BELOW AND RETURN THESE PAGES AND THE PROPOSAL FORM IN ADDITION TO SUBMITTING ANY DOCUMENTS CALLED FOR BY THE GENERAL CONDITIONS AND INSTRUCTIONS TO BIDDERS, SPECIFICATIONS, AND ANY OTHER DOCUMENTS HEREIN CONTAINED.

By signing here, Bidder does hereby attest that he/she has read fully the general conditions and instructions, specifications, and any other documents herein contained, and does understand them and will furnish and deliver all labor and materials in accordance with the specifications for the price as listed on the proposal form.

Bidder acknowledges receipt of Addenda by initialing the following:

Addendum No. 1 \_\_\_\_\_ Addendum No. 2 \_\_\_\_\_ Addendum No. 3 \_\_\_\_\_  
Addendum No. 4 \_\_\_\_\_ Addendum No. 5 \_\_\_\_\_ Addendum No. 6 \_\_\_\_\_

BIDDER'S COMPANY/FIRM:

\_\_\_\_\_

ADDRESS:

\_\_\_\_\_

AUTHORIZED SIGNATURE:

\_\_\_\_\_

NAME AND TITLE PRINTED:

\_\_\_\_\_

TELEPHONE & FAX NUMBER:

\_\_\_\_\_

E-MAIL ADDRESS:

\_\_\_\_\_

DATE: \_\_\_\_\_

FEDERAL EMPLOYER'S IDENTIFICATION NO. \_\_\_\_\_

***For Informational Purposes Only:*** Has your company/firm been certified by the State of Maryland as a Minority Business Enterprise? (Please check.) \_\_\_\_\_ Yes \_\_\_\_\_ No

**PUR-1436**

**BID DOCUMENT SCHEDULE**

<b>Document</b>	<b>Due Date</b>	<b>Required By</b>
Bid Bond	With Bid	All Bidders
Provisions for Other Agencies	With Bid	All Bidders
Signature to Bids	With Bid	All Bidders
Form of Proposal	With Bid	All Bidders
Affidavit of Non-Collusion and Bribery Convictions	With Bid	All Bidders
Equal Employment Opportunity Certification	With Bid	All Bidders
Certification of Non-Segregated Facilities	With Bid	All Bidders
Disadvantaged Business Enterprise (DBE) Form DEBC-1	With Bid	All Bidders
Buy American Certificate	With Bid	All Bidders
Certificate of Buy American Compliance for Manufactured Products	With Bid	All Bidders
Certificate of Buy American Compliance for Total Facility	With Bid	All Bidders
Certification of Offerer/Bidder Regarding Tax Delinquency and Felony Convictions	With Bid	All Bidders
Schedule of Values	48 hours after Bid Opening	Low Bidder
List of subcontractors	48 hours after Bid Opening	Low Bidder
Disadvantaged Business Enterprise (DBE) Plan as described on Form DEBC-1	Within 5 days after the Opening of Bids	All Bidders wishing to remain in competition for the Contract
Performance/Labor and Material Bonds	Within 15 days of Notice of Award	Successful Bidder only
Certificates of Insurance	Prior to Notice to Proceed	Successful Bidder only

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**PUR-1436**  
**FORM OF PROPOSAL**

(Submit Form of Proposal)

**Board of County Commissioners  
of Washington County, Maryland  
(hereinafter called "Owner")  
c/o Washington County Purchasing Department  
100 West Washington Street, Room 3200  
Hagerstown, MD 21740-4748**

**BIDS DUE:**  
**Date: Wednesday, August 7, 2019**  
**Time: No later than 2:00 P.M., (EST)**

Project Name: **Terminal Building Expansion**  
Washington County Bid No.: **PUR-1436**

Proposal of \_\_\_\_\_ (hereinafter  
called "Bidder"), \*a corporation, organized and existing under the laws of the State of \_\_\_\_\_,  
\*a partnership, or an individual doing business as \_\_\_\_\_.

Telephone No. (\_\_\_\_) \_\_\_\_\_ Fax :) \_\_\_\_\_

Contact: Name & Title Printed: \_\_\_\_\_  
Address: \_\_\_\_\_  
E-Mail Address: \_\_\_\_\_

\*Insert corporation, partnership or individual as applicable.

**Gentlemen/Ladies:**

The Bidder, in compliance with your Invitation for Bids for the abovementioned project has examined the plans and specifications with related documents and the size of the proposed work, and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of materials and labor, hereby proposes to furnish all labor, materials, equipment, plant and services, and to construct the project in accordance with the Contract Documents and Addenda within the time set forth therein, and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this proposal is a part.

We hereby submit our proposal for the **Terminal Building Expansion – Hagerstown Regional Airport - Richard A. Henson Field.**

Having carefully examined the Contract Documents for the subject construction project -

Specifications Dated July 2019  
Drawings Dated July 2019

Addenda No. \_\_\_\_ Date \_\_\_\_\_, No. \_\_\_\_ Date \_\_\_\_\_, No. \_\_\_\_ Date \_\_\_\_\_  
Addenda No. \_\_\_\_ Date \_\_\_\_\_, No. \_\_\_\_ Date \_\_\_\_\_, No. \_\_\_\_ Date \_\_\_\_\_

and having received clarification on all items of conflict or upon which any doubt arose, the undersigned proposes to properly complete the work, in strict accordance with the Contract Documents, for the stipulated sum of, based on the unit prices set forth in the attached Schedule of Prices:

**1. TOTAL SUM BID:**

To furnish labor, materials, equipment, plant and services necessary to properly complete the work required under the TOTAL LUMP SUM BID, based on the price set forth as shown below in strict accordance with the aforesaid documents, and to be substantially completed within three hundred and sixty five (365) consecutive calendar days of Notice to Proceed.

**Base Bid:**

	Dollars \$	
(Written)		(Figures)
<b>Add Alternate No. 1 – Passenger Boarding Bridge and Interior Ramp:</b>		
	Dollars \$	
(Written)		(Figures)
<b>Add Alternate No. 2 – Main Terminal Flooring Replacement:</b>		
	Dollars \$	
(Written)		(Figures)
<b>Add Alternate No. 3 - Airline/Concession/Rental Car Counters:</b>		
	Dollars \$	
(Written)		(Figures)
<b>Add Alternate No. 4 - Main Terminal Paint and Wall Finishes</b>		
	Dollars \$	
(Written)		(Figures)
<b>Add Alternate No. 5 – Exterior Canopies</b>		
	Dollars \$	
(Written)		(Figures)
<b>Add Alternate No. 6 – New Generator</b>		
	Dollars \$	
(Written)		(Figures)

(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

Washington County will award this Project based on the total Base Bid only or Base Bid and any combination of Add Alternates included in the Contract Documents, whichever is in the best interest of the County.

It is understood that the bid price will be firm for a time period of one hundred and twenty (120) calendar days from the bid opening date and that if the undersigned is notified of acceptance of this proposal within this time period, the firm shall complete the total work within three hundred and sixty five (365) consecutive calendar days from the date of "Notice to Proceed" for construction and to complete the work in accordance with the provisions of the Contract Documents. If this work is not completed within the time period specified, the Contractor will be liable for liquidated damages of one thousand five hundred (\$1,500.00) dollars per consecutive calendar day will be applied.

2. **SUBCONTRACTORS:**

- A. All Bidders shall submit their list of subcontractors list as part of their bid packet.
- B. No change or deviation from this list shall be allowed except as determined by the Owner or the Owner's Representative.

3. **AWARD:** Award of the bid can be made by the Owner to the responsive, responsible low bidder based on the Total Sum Bid.

4. **BIDDER'S STATE OF MARYLAND REGISTRATION NUMBER:**

_____	_____	_____
Construction Firm License No.	Date Issued	Place of Issuance
_____		
Federal Employer Identification Number (FEIN) or Social Security No. if no FEIN		

Bid Security Bonds shall be submitted with each proposal in the amount of five percent (5%) of the Total Sum Bid.

Bid Bonds, except those of the two (2) low bidders will be returned after the bid opening. Other bid bonds will be returned after the related contract has been executed. If no bid has been accepted within one hundred and twenty (120) calendar days after the bid opening, then any bond may be returned upon demand of the bidder.

Upon receipt of written notice of the acceptance of this bid, bidder will execute the formal contract within fifteen (15) calendar days. The Bid Security attached, in the sum of:

_____	Dollars \$	_____
(Written)		(Figures)

Is to become the property of the Owner in the event the Contract and Bond are not executed within the time set forth above, as liquidated damages for the delay and additional expense to the Owner caused thereby.

Failure to properly and completely fill in all blanks may be cause for rejection of this proposal. All alternates and unit prices called for in the Contract Documents must be submitted herewith.

Dated: \_\_\_\_\_

\_\_\_\_\_  
BIDDER'S NAME

BIDDER'S SEAL

BY: \_\_\_\_\_  
SIGNATURE AND TITLE

\_\_\_\_\_  
ADDRESS

\_\_\_\_\_  
CITY STATE ZIP

INSTRUCTIONS:

The bidder shall provide a Schedule of Values from in accordance with the Specification Section 00 43 73 Proposed Schedule of Values Form.

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### BID BOND

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned \_\_\_\_\_ as Principal, and \_\_\_\_\_ as Surety, are hereby held and firmly bound unto the Board of County Commissioners of Washington County, Maryland as OWNER in the penal sum of \_\_\_\_\_ (five percent (5%) of Total Bid) for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed, this \_\_\_\_\_ day of \_\_\_\_\_, 2019. The Condition of the above obligation is such that whereas the Principal has submitted to the Board of County Commissioners of Washington County, Maryland a certain BID, attached hereto and hereby made a part hereof to enter into a contract in writing, for **Contract No. PUR-1436 Terminal Building Expansion, Hagerstown Regional Airport - Richard A. Henson Field.**

NOW, THEREFORE,

- (a) If said BID shall be rejected, or
- (b) If said BID shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attachment hereto (Properly completed in accordance with said BID) and shall furnish a BOND for **faithful** performance of said contract, and for the payment of all persons performing labor furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said BID, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by any extension of the time within which the OWNER may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

\_\_\_\_\_  
Principal

\_\_\_\_\_  
Surety

By: \_\_\_\_\_

**IMPORTANT** - Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and authorized to transact business in the State where the project is located.

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## **AFFIDAVIT OF NON-COLLUSION AND BRIBERY CONVICTIONS**

### **AFFIRMATION REGARDING COLLUSION**

I AFFIRM THAT:

Neither I nor, to the best of my knowledge, information, and belief, the below stated business has:

- (a) Agreed, conspired, connived, or colluded to produce a deceptive show of competition in the compilation of the accompanying bid or offer that is being submitted;
- (b) In any manner, directly or indirectly, entered into any agreement of any kind to fix the bid price or price proposal of the Bidder or Offeror or of any competitor, or otherwise taken any action in restraint of free competitive bidding in connection with the contract for which the accompanying bid or offer is submitted.

### **AFFIRMATION REGARDING BRIBERY CONVICTIONS**

I FURTHER AFFIRM:

Neither I nor, to the best of my knowledge, information, and belief, the below business (as is defined in Section 16-101 (b) of the State Finance and Procurement Article of the Annotated Code of Maryland), or any of its officers, directors, partners, or any of its employees directly involved in obtaining or performing contracts with public bodies (as is defined in Section 16-101(f) of the State Finance and Procurement Article of the Annotated Code of Maryland), has been convicted of, or has had probation before judgment imposed pursuant to Criminal Procedure Article, Section 6-220 of the Annotated Code of Maryland, or has pleaded nolo contendere to a charge of, bribery, attempted bribery, or conspiracy to bribe in violation of Maryland law, or of the law of any other State or federal law, **except as follows** (indicate the reasons why the affirmation cannot be given and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of person(s) involved, and their current positions and responsibilities with the business):

---

---

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THE ABOVE-REFERENCED AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION AND BELIEF AND THAT I AM THE DULY AUTHORIZED REPRESENTATIVE OF THE BELOW BUSINESS AND THAT I POSSESS THE LEGAL AUTHORITY TO MAKE THE AFFIDAVITS AND CERTIFICATION ON BEHALF OF MYSELF AND THE BUSINESS FOR WHICH I AM ACTING.

BY:

---

(Signature of Authorized Representative and Affiant)

\_\_\_\_\_  
(Name & Title Printed)

\_\_\_\_\_  
(Business Address)

\_\_\_\_\_  
(Phone Number)

/ \_\_\_\_\_  
(Fax Number)

\_\_\_\_\_  
(Federal Employer Identification Number)

(SEAL) If bid is by corporation.



**BIDDER'S EQUAL EMPLOYMENT  
OPPORTUNITY CERTIFICATION (EEOC)**

Section 151.54(d)(1) of the FAA Regulations requires each bidder or prospective Contractor or any of their proposed subcontractors, to state as an initial part of the bid whether it has participated in any previous contract or subcontract subject to the equal employment opportunity clause; and, if so, whether it has filed with the Committee or agency all compliance reports due under applicable instructions. In any case in which a bidder or prospective Contractor or proposed Contractor which has participated in a previous contract or subcontract subject to the equal employment opportunity clause has not filed a compliance report due under applicable instructions, such bidder, prospective Contractor, or proposed subcontractor shall be required to submit a compliance report prior to the award of the proposed contract or subcontract [41 CFR 60-1.6(b)(1)].

The bidder shall complete the following statement by checking the appropriate spaces. Failure to complete will result in a non-responsive bid.

The bidder has \_\_\_\_, has not \_\_\_\_, participated in a previous contract subject to the discrimination clause prescribed by Executive Order 10925 dated March 6, 1961, or Executive Order 11114 dated June 22, 1963, or Executive Order 11246 dated September 24, 1965.

The bidder has \_\_\_\_, has not \_\_\_\_, submitted compliance reports as required by applicable instructions, the successful bidder will be required to submit a Standard Form 100 (for Federally-Assisted Construction Contracts) before award.

Certification: The information above is true and complete to the best of my knowledge and belief.

\_\_\_\_\_  
Name and Title of Signer

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

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### **CERTIFICATION OF NON-SEGREGATED FACILITIES**

The federally-assisted construction contractor certifies that it does not maintain or provide, for its employees, any segregated facilities at any of its establishments and that it does not permit employees to perform services where segregated facilities are maintained. The federally assisted construction contractor certifies further that it will not maintain or provide, for its employees, segregated facilities at any of its establishments, and that it will not permit its employees to perform services at any location, under its control, where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the equal opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating area, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities pro-vided for employees which are segregated by explicit directives or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or any other reason. The federally assisted construction contractor agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the equal opportunity clause and that he will retain such certifications in his files.

#### **NOTICE TO PROSPECTIVE CONTRACTORS OF REQUIREMENT FOR CERTIFICATION FOR NONSEGREGATED FACILITIES:**

A Certification of Non-Segregated Facilities must be submitted prior to the award of a contract or subcontract exceeding \$10,000 which is not exempt from the provisions of the equal opportunity clause.

Certification - The information above is true and complete to the best of my knowledge and belief.

\_\_\_\_\_  
Name and Title of Signer (Please Type)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

BIDDERS NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

INTERNAL REVENUE SERVICE EMPLOYER IDENTIFICATION NUMBER \_\_\_\_\_

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## **HAGERSTOWN REGIONAL AIRPORT – RICHARD A. HENSON FIELD**

### **DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM**

In accordance with Federal Regulations (49 CFR Part 23) and Department of Transportation guidelines, it is the policy of The Board of County Commissioners of Washington County, Maryland and Hagerstown Regional Airport – Richard A. Henson Field to utilize Disadvantaged Business Enterprises (DBE) in all aspects of contracting.

The percentage of dollar awards on each Airport Improvement Program or Planning Grant Program project has been established at nine and seventy-two hundredths percent (9.72%).

It is the position of the Board of County Commissioners of Washington County, Maryland and Hagerstown Regional Airport – Richard A. Henson Field that DBE's be afforded the opportunity to actively participate in the economic mainstream of architectural, engineering, construction, and other service activities involving the use of Federal funds. The participation goal is a percentage of the dollar amount of each grant based on a project to project basis.

Selection will be based on the determination of whether or not the competitor offering the lowest responsible price has also met the established DBE goals, unless said bidder submits, in writing, an acceptable explanation as to why the DBE involvement is at a lower percentage or absent entirely from the project bid. This written explanation must show that the Contractor has made every effort to identify and solicit DBE involvement.

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### **BIDDER'S DBE CERTIFICATION**

To meet the requirements of Department of Transportation, Regulation 49 CFR Part 23, all bidders will provide evidence of the methods they have used to meet the Disadvantaged Business Enterprise goal as published in the Sponsor's Disadvantaged Business Enterprise Plan and approved by the Department of Transportation. The DBE participation goal for this project is nine and seventy-two hundredths percent (9.72%).

All bidders must submit an assurance stating the percentage of Disadvantaged Businesses they intend to employ on this project.

WITHIN 5 DAYS AFTER THE OPENING OF BIDS AND BEFORE THE AWARD OF A CONTRACT, ALL BIDDERS OR PROPOSERS WISHING TO REMAIN IN COMPETITION FOR THE CONTRACT SHALL SUBMIT:

1. Names of the DBE subcontractors they intend to use.
2. Description of work each DBE subcontractor is to perform.
3. The dollar amount of the participation of each DBE firm.
4. Written statement from Bidder or Offeror that attests their commitment to use the DBE firm(s) provided with the Bid Proposal to meet the Owner's project goal; and
5. If Bidder or Offeror cannot meet the advertised project DBE goal, evidence of good faith efforts undertaken by the Bidder or Offeror as described in appendix A to 49 CFR part 26.

REQUIRED ASSURANCE TO BE INCLUDED IN ALL BID PROPOSALS.

This firm assures that it will utilize not less than \_\_\_\_% of Disadvantaged Business participation.

CERTIFICATION OF BIDDER FOR THE ABOVE:

\_\_\_\_\_  
AUTHORIZED REPRESENTATIVE

\_\_\_\_\_  
DATE

\_\_\_\_\_  
NAME

\_\_\_\_\_  
TITLE

\_\_\_\_\_  
COMPANY

(SEAL)

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## SUBCONTRACTORS AND SUPPLIERS

Low bidder shall provide the Subcontractor and supplier list to the Owner within 48 hours of the bid opening. If a subcontractor or supplier is a Disadvantaged Business Enterprise (DBE), please indicate it on this list.

No.	Name of the Subcontractor/Supplier and Description of Work to be Performed	Contact Name/Tel. No.	Approximate Value

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## BUY AMERICAN CERTIFICATE

By submitting a bid under this solicitation, except for those items listed by the offeror below or on a separate and clearly identified attachment to this bid the offeror certifies that steel and each manufactured product, are produced in the United States, as defined in the clause Buy American – Steel and Manufactured Products for Construction Contracts and that components of unknown origin are considered to have been produced or manufactured outside the United States.

Offerors may obtain from the owner a listing of articles, materials, and supplies excepted from this provision.

Product	Country of Origin

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**BID NO. PUR-1436  
TERMINAL BUILDING EXPANSION  
FOR  
HAGERSTOWN REGIONAL AIRPORT  
RICHARD A. HENSON FIELD  
AIP 3-24-0019-059-2018 (DESIGN); MAA-GR-19-009 (DESIGN)**

**Certificate of Buy American Compliance for Total Facility**

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with its proposal. The bidder or offeror must indicate how it intends to comply with 49 USC § 50101 by selecting one of the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (i.e. not both) by inserting a checkmark (✓) or the letter "X".

- ☐ Bidder or offeror hereby certifies that it will comply with 49 USC § 50101 by:
- a) Only installing steel and manufactured products produced in the United States; or
  - b) Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
  - c) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

- To provide to the Owner evidence that documents the source and origin of the steel and manufactured product.
- To faithfully comply with providing U.S. domestic products.
- To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

- ☐ The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 USC § 50101(a) but may qualify for either a Type 3 or Type 4 waiver under 49 USC § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:
- a) To submit to the Owner within 15 calendar days of the bid opening, a formal waiver request and required documentation that supports the type of waiver being requested.
  - b) That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination that may result in rejection of the proposal.

- c) To faithfully comply with providing U.S. domestic products at or above the approved U.S. domestic content percentage as approved by the FAA.
- d) To furnish U.S. domestic product for any waiver request that the FAA rejects.
- e) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

### Required Documentation

**Type 3 Waiver** – The cost of components and subcomponents produced in the United States is more than 60 percent of the cost of all components and subcomponents of the “facility”. The required documentation for a Type 3 waiver is:

- a) Listing of all manufactured products that are not comprised of 100 percent U.S. domestic content (excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety).
- b) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly and installation at project location.
- c) Percentage of non-domestic component and subcomponent cost as compared to total “facility” component and subcomponent costs, excluding labor costs associated with final assembly and installation at project location.

**Type 4 Waiver** – Total cost of project using U.S. domestic source product exceeds the total project cost using non-domestic product by 25 percent. The required documentation for a Type 4 of waiver is:

- a) Detailed cost information for total project using U.S. domestic product
- b) Detailed cost information for total project using non-domestic product

**False Statements:** Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Company Name

\_\_\_\_\_  
Title

**BID NO. PUR-1436  
TERMINAL BUILDING EXPANSION  
FOR  
HAGERSTOWN REGIONAL AIRPORT  
RICHARD A. HENSON FIELD  
AIP 3-24-0019-059-2018 (DESIGN); MAA-GR-19-009 (DESIGN)**

**Certificate of Buy American Compliance for Manufactured Products**

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with their proposal. The bidder or offeror must indicate how they intend to comply with 49 USC § 50101 by selecting one of the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (not both) by inserting a checkmark (✓) or the letter "X".

- ☐ Bidder or offeror hereby certifies that it will comply with 49 USC § 50101 by:
1. Only installing steel and manufactured products produced in the United States;
  2. Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
  3. Installing products listed as an Excepted Article, Material, or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

1. To provide to the Owner evidence that documents the source and origin of the steel and manufactured product.
  2. To faithfully comply with providing U.S. domestic product.
  3. To furnish U.S. domestic product for any waiver request that the FAA rejects.
  4. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.
- ☐ The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 USC § 50101(a) but may qualify for either a Type 3 or Type 4 waiver under 49 USC § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:
1. To submit to the Owner within 15 calendar days of the bid opening, a formal waiver request and required documentation that supports the type of waiver being requested.
  2. That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination may result in rejection of the proposal.

3. To faithfully comply with providing U.S. domestic products at or above the approved U.S. domestic content percentage as approved by the FAA.
4. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

### Required Documentation

**Type 3 Waiver** – The cost of the item components and subcomponents produced in the United States is more than 60 percent of the cost of all components and subcomponents of the “item”. The required documentation for a Type 3 waiver is:

- a) Listing of all product components and subcomponents that are not comprised of 100 percent U.S. domestic content (Excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety).
- b) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly at place of manufacture.
- c) Percentage of non-domestic component and subcomponent cost as compared to total “item” component and subcomponent costs, excluding labor costs associated with final assembly at place of manufacture.

**Type 4 Waiver** – Total cost of project using U.S. domestic source product exceeds the total project cost using non-domestic product by 25 percent. The required documentation for a Type 4 of waiver is:

- a) Detailed cost information for total project using U.S. domestic product
- b) Detailed cost information for total project using non-domestic product

**False Statements:** Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Company Name

\_\_\_\_\_  
Title



**BID NO. PUR-1436  
TERMINAL BUILDING EXPANSION  
HAGERSTOWN REGIONAL AIRPORT - RICHARD A. HENSON FIELD  
AIP 3-24-0019-059-2018 (DESIGN); MAA-GR-19-009 (DESIGN)**

**CERTIFICATION OF OFFERER/BIDDER REGARDING TAX DELINQUENCY AND  
FELONY CONVICTIONS**

The applicant must complete the following two certification statements. The applicant must indicate its current status as it relates to tax delinquency and felony conviction by inserting a checkmark (✓) in the space following the applicable response. The applicant agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification in all lower tier subcontracts.

**Certifications**

- 1) The applicant represents that it is (    ) is not (    ) a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.
- 2) The applicant represents that it is (    ) is not (    ) a corporation that was convicted of a criminal violation under any Federal law within the preceding twenty-four (24) months.

**Note**

If an applicant responds in the affirmative to either of the above representations, the applicant is ineligible to receive an award unless the sponsor has received notification from the agency suspension and debarment official (SDO) that the SDO has considered suspension or debarment and determined that further action is not required to protect the Government's interests. The applicant therefore must provide information to the owner about its tax liability or conviction to the Owner, who will then notify the FAA Airports District Office, which will then notify the agency's SDO to facilitate completion of the required considerations before award decisions are made.

**Term Definitions**

**Felony conviction:** Felony conviction means a conviction within the preceding twenty-four (24) months of a felony criminal violation under any Federal law and includes conviction of an offense defined in a section of the U.S. code that specifically classifies the offense as a felony and conviction of an offense that is classified as a felony under 18 U.S.C. § 3559.

**Tax Delinquency:** A tax delinquency is any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

### **CERTIFICATION REGARDING LOBBYING**

I CERTIFY:

By signing and submitting this bid or proposal, to the best of my knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Bidder or Offeror, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

---

Date

---

Signature

---

Company Name

---

Title

**TERMINAL BUILDING EXPANSION  
HAGERSTOWN REGIONAL AIRPORT-RICHARD A. HENSON FIELD  
AIP 3-24-0019-059-2018 (DESIGN); MAA-GR-19-009 (DESIGN)**

**BID NO. PUR-1436  
BID DOCUMENTS  
JULY 2019**

## **SECTION 2 FORM OF CONTRACT**

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**PUR-1436  
TERMINAL BUILDING EXPANSION  
HAGERSTOWN REGIONAL AIRPORT - RICHARD A. HENSON FIELD  
AIP 3-24-0019-059-2018 (DESIGN); MAA-GR-19-009 (DESIGN)**

**CONTRACT AGREEMENT BY AND BETWEEN THE**

**BOARD OF COUNTY COMMISSIONERS OF  
WASHINGTON COUNTY, MARYLAND**

**AND**

THIS CONTRACT AGREEMENT (hereinafter the "Contract"), is made this \_\_\_\_\_ day of \_\_\_\_\_, 2019, by and between (hereinafter the "Contractor") and the **BOARD OF COUNTY COMMISSIONERS OF WASHINGTON COUNTY, MARYLAND**, a body corporate and politic and a political subdivision of the State of Maryland, (hereinafter the "County").

**RECITALS**

This Contract for the construction of **Contract No. PUR-1436**, Terminal Building Expansion at Hagerstown Regional Airport - Richard A. Henson Field, near Hagerstown, Washington County, Maryland, as shown on the drawings identified in the same manner, with a final approval date of March, 2019, on file at the Hagerstown Regional Airport, Maryland, subject to all the conditions, covenants, stipulations, terms and provisions contained in the Specifications, the Specifications being in all respects incorporated herein by reference and made a part hereof as if attached or entirely stated herein, has recently been awarded to the Contractor by the County, at and for a sum equal to the prices and rates respectively named therefore in the bid.

One of the conditions of said award is that a formal contract be executed by and between the Contractor and the County evidencing the terms of said award.

NOW, THEREFORE, in consideration of the mutual covenants, conditions and agreements herein contained, the parties hereby agree as follows:

1. The "Contract Documents," except for modifications issued after the execution of this Contract, are enumerated as follows and are incorporated herein by reference and made a part hereof as if attached or entirely stated herein:

*Invitation to Bid*

*General Conditions and Instructions to Bidder*

*Supplemental Terms and Conditions*

*The Insurance Requirements for Independent Contractors*

*Provisions for Other Agencies*

*Wage Rates*

*Signature to Bids*

*Bid Document Schedule*

*Form of Proposal*  
*Bid Bond*  
*Affidavit of Non-Collusion and Bribery Convictions*  
*Bidders EEOC*  
*Certification of Non-Segregated Facilities*  
*DBE Program*  
*DBE Certification*  
*Subcontractors and Suppliers*  
*Buy American Certificate*  
*Certificate of Buy American Compliance for Total Facility*  
*Certificate of Buy American Compliance for Manufactured Products*  
*Certification of Offeror/Bidder Regarding Tax Delinquency and Felony Convictions and Lobbying*  
*The executed Contract Agreement between the County and the Contractor*  
*Labor and Material Payment Bond*  
*Performance Bond*  
*FAA General Provisions*  
*Federal Requirements for AIP Program Contracts*  
*Technical Specifications*  
*Notice of Award*  
*Notice to Proceed*

*Contract Drawings dated July 2019 \_\_\_\_\_*

2. The date of commencement and substantial completion of the project contemplated herein shall be as set forth in the Instructions to Bidders and stipulated by the Notice to Proceed or an authorized extension thereof.
3. The Contractor shall complete **Contract No. PUR-1436**, Terminal Building Expansion at Hagerstown Regional Airport - Richard A. Henson Field , near Hagerstown, Washington County, Maryland, in accordance with each and every one of the conditions, covenants, stipulations, terms and provisions contained in the aforementioned Specifications, which in all respects are incorporated herein by reference and made a part hereof as if attached or entirely stated herein, and as shown on the aforementioned drawings, which are also incorporated herein by reference and made a part hereof as if attached or entirely stated herein, at and for a sum equal to the prices and rates respectively named therefore in the bid attached hereto, and shall comply with and perform each and every obligation imposed upon it by the said Specifications or by the terms of said award.
4. The County shall comply with and perform each and every obligation imposed upon it by the said Specifications or by the terms of the said award.
5. The County shall pay the Contractor for the Contractor's performance of the Contract the sum of \_\_\_\_\_ Dollars and \_\_\_\_\_ Cents (\$ \_\_\_\_\_) (hereinafter the "Contract Sum"), when due and payable under the terms of the said Specifications and the terms of said award and shall be subject to additions and deductions as provided for in the Contract Documents.

6. Payments shall be made on account of the Contract Sum to the Contractor as set forth in the Contract Documents.
7. The Contractor hereby certifies that it is a corporation authorized and registered to do business in the State of Maryland with the Maryland State Department of Assessments and Taxation.
8. The Contractor hereby certifies that it has read and understood the provisions of the Washington County Purchasing guidelines dealing with conflicts of interest, and that it further certifies, represents and warrants to the County that there is no current conflict of interest and that the Contractor shall refrain from any such conflict of interest for the duration of this Contract.
9. This Contract was made and entered into in the State of Maryland and shall be governed and construed in accordance with the laws of the State of Maryland. As to the Contractor, this Contract is intended to be a contract under seal and specialty.
10. The Recitals are incorporated into this Contract as substantive provisions.

IN WITNESS WHEREOF, the parties have caused this Contract to be duly executed and delivered, the day and year first above written.

**APPROVED AND AGREED TO:**

**ATTEST:**

\_\_\_\_\_

BY: \_\_\_\_\_  
(Signature)

**APPROVED AND AGREED TO:**

**ATTEST:**

**BOARD OF COUNTY COMMISSIONERS  
OF WASHINGTON COUNTY, MARYLAND**

\_\_\_\_\_  
Krista L. Hart, Clerk

\_\_\_\_\_  
Jeffery A. Cline, President

(SEAL)

**Recommended for approval:**

\_\_\_\_\_  
Garrison Plessinger, Director  
Hagerstown Regional Airport

**Approved for Legal Sufficiency:**

\_\_\_\_\_  
Kirk C. Downey  
County Attorney

**END OF DOCUMENT**



**LABOR AND MATERIAL PAYMENT BOND**

Board of County Commissioners of Washington County, Maryland

BOND NO. \_\_\_\_\_

CONTRACT NO. **PUR-1436**

Date Bond Executed: \_\_\_\_\_, 2019

KNOW ALL MEN BY THESE PRESENTS, that we \_\_\_\_\_,

\_\_\_\_\_  
(Here insert full name and address or legal title of Contractor, including zip code)

a corporation organized and existing under the laws of the State of Maryland and authorized to do business in the State of Maryland, hereinafter called the **“Principal”** and

\_\_\_\_\_  
(Here insert full name and address or legal title of Surety, including zip code)

a corporation organized and existing under the laws of the State of \_\_\_\_\_, and authorized to do business in the State of Maryland, hereinafter called the **“Surety”**, are held and firmly bound unto the Board of County Commissioners of Washington County, Maryland, a body corporate and politic, and a political subdivision of the State of Maryland, hereinafter called the **“County”**, for the use and benefit of claimants as hereinafter defined, in the Penal Sum \_\_\_\_\_ Dollars and \_\_\_\_\_ Cents (\$ \_\_\_\_\_) lawful money, for the payment of which Penal Sum we bind ourselves, our heirs, executors, administrators, personal representatives, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into or will enter into a contract with the County, for the Terminal Building Expansion – Hagerstown Regional Airport - Richard A. Henson Field (***Contract No. PUR-1436***), in ***Washington County, Maryland***. The contract and all items incorporated into the contract, together with any and all changes, extensions of time, alterations, modifications, or additions to the contract or to the work to be performed there under or to the Plans, Specifications, and Special Provisions, or any of them, or to any other items incorporated into the contract shall hereinafter be referred to as the **“Contract”**.

WHEREAS, it is one of the conditions precedent to the final award of the Contract that these presents be executed.

NOW, THEREFORE, the condition of this obligation is such that if the Principal shall promptly make payment to all claimants as hereinafter defined, for all labor and materials furnished, supplied and reasonably required for use in the performance of the Contract, then this obligation shall be null and void, otherwise it shall remain in full force and effect, subject to the following conditions:

1. A **Claimant** is defined to be any and all of those persons supplying labor and materials (including lessors of the equipment to the extent of the fair market value thereof) to the Principal or its subcontractors and sub-subcontractors in the prosecution of the work

provided for the Contract, entitled to the protection provided by Md. Code Ann., State Finance and Procurement Article, §17-101, *et seq.*, as from time to time amended.

2. The above-named Principal and Surety hereby jointly and severally agree with the County that every claimant as herein defined, who has not been paid in full may, pursuant to and when in compliance with the provisions of the aforesaid State Finance and Procurement Article, §17-101, *et seq.*, sue on this Bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant and have execution thereon. The County shall not be liable for the payment of any costs or expenses of any such suit.

The Surety hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the Contract or to the work to be performed thereunder of the Specifications accompanying the same shall in any way affect its obligations on this Payment Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work or the Specifications.

This Payment Bond shall be governed and construed in accordance with the laws of the State of Maryland and any reference herein to the Principal or Surety in the singular shall include all entities in the plural who or which are signatories under the Principal or Surety heading below.

IN WITNESS WHEREOF, the Principal and Surety have set their hands and seals to this Payment Bond this \_\_\_\_\_ day of \_\_\_\_\_, 2019.

**WITNESS:**

\_\_\_\_\_  
(Typed Name of Principal)

BY: \_\_\_\_\_ (SEAL)

\_\_\_\_\_  
(Typed Name and Title)

**WITNESS:**

\_\_\_\_\_  
(Typed Name of Surety)

BY: \_\_\_\_\_ (SEAL)

\_\_\_\_\_  
(Typed Name and Title)

\_\_\_\_\_  
(Name of Local Agent)

(\_\_\_\_\_) \_\_\_\_\_  
(Telephone Number of Local Agent)

## PERFORMANCE BOND

Board of County Commissioners of Washington County, Maryland

BOND NO. \_\_\_\_\_

CONTRACT NO. PUR-1436

Date Bond Executed: \_\_\_\_\_, 2019

KNOW ALL MEN BY THESE PRESENTS, that we

\_\_\_\_\_  
(Here insert full name and address or legal title of Contractor, including zip code)

a corporation organized and existing under the laws of the State of \_\_\_\_\_ and authorized to do business in the State of Maryland, hereinafter called the **“Principal”** and

\_\_\_\_\_  
(Here insert full name and address or legal title of Surety, including zip code)

a corporation organized and existing under the laws of the State of \_\_\_\_\_ and authorized to do business in the State of Maryland, hereinafter called the **“Surety”**, are held and firmly bound unto the Board of County Commissioners of Washington County, Maryland, hereinafter called the **“County”**, the sum of \_\_\_\_\_ Dollars and \_\_\_\_\_ Cents (\$ \_\_\_\_\_) lawful money of the United States for the payment of which sum well and truly to be made, the Principal and the Surety bind themselves, their heirs, personal representatives, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into or will enter into a contract with the County for the Terminal Building Expansion – Hagerstown Regional Airport - Richard A. Henson Field (**Contract No. PUR-1436, hereinafter the “Contract”**), in Washington County, Maryland, which Contract and all work to be done thereunder and all the plans, drawings, and specifications accompanying the same shall be deemed a part hereof and shall be incorporated by reference herein to the same extent as if fully set forth.

NOW, THEREFORE, during the original term of said Contract, during any extensions thereto that may be granted by the County, and during the guarantee and warranty period, if any, required under the Contract, unless otherwise stated therein, this Performance Bond shall remain in full force and effect unless and until the following terms and conditions are met:

1. Principal shall well and truly perform the Contract; and
2. Principal and Surety shall comply with the terms and conditions in this Performance Bond.

Whenever Principal shall be declared by the County to be in default under the Contract, the Surety may, within ten (10) days after notice of default from the County, notify the County of its election to either promptly proceed to remedy the default or promptly proceed to complete the Contract in accordance with and subject to its terms and conditions. In the event the Surety does not elect to exercise either of the above stated options, then the County thereupon shall have the remaining contract work completed, Surety to remain liable hereunder for all expenses of completion up to but not exceeding the penal sum stated above.

The Surety for value received hereby stipulates and agrees that no change, extension of time,

alteration, or addition to the terms of the Contract or to the work to be performed thereunder of the Specifications accompanying the same shall in any way affect its obligations on this Performance Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder of the specifications accompanying the same.

This Performance Bond shall be governed by and construed in accordance with the laws of the State of Maryland and any reference herein to Principal or Surety in the singular shall include all entities in the plural who or which are signatories under the Principal or Surety heading below.

IN WITNESS WHEREOF, Principal and Surety have set their hands and seals to this Performance Bond. If any individual is a signatory under the Principal heading below, then each such individual has signed below on his or her own behalf, has set forth below the name of the firm, if any, in whose name he or she is doing business, and has set forth below his or her title as a sole proprietor. If any partnership or joint venture is a signatory under the Principal heading below, then all members of each such partnership or joint venture, and each member has set forth below his or her title as a general partner, limited partner, or member of joint venture, whichever is applicable. If any corporation is a signatory under the Principal or Surety heading below, then each such corporation has caused the following: the corporation's name to be set forth below, a duly authorized representative of the corporation to affix below the corporation's seal and to attach hereto a notarized corporate resolution or power of attorney authorizing such action, and each such duly authorized representative to sign below and to set forth below his or her title as a representative of the corporation. If any individual acts as a witness to any signature below, then each such individual has signed below and has set forth below his or her title as a witness. All of the above has been done as of the Date of Bond shown above.

Signed, and sealed this \_\_\_\_\_ day of \_\_\_\_\_, 2019.

**WITNESS:**

\_\_\_\_\_  
(Typed Name of Principal)

BY: \_\_\_\_\_ (SEAL)

\_\_\_\_\_  
(Typed Name and Title)

**WITNESS:**

\_\_\_\_\_  
(Typed Name of Surety)

BY: \_\_\_\_\_ (SEAL)

\_\_\_\_\_  
(Typed Name and Title)

\_\_\_\_\_  
(Name of Local Agent)

( \_\_\_\_\_ )  
(Telephone Number of Local Agent)

## **SECTION 3 FAA GENERAL PROVISIONS**

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## Section 10 Definition of Terms

When the following terms are used in these specifications, in the contract, or in any documents or other instruments pertaining to construction where these specifications govern, the intent and meaning shall be defined as follows:

Paragraph Number	Term	Definition
10-01	<b>AASHTO</b>	The American Association of State Highway and Transportation Officials.
10-02	<b>Access Road</b>	The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public roadway.
10-03	<b>Advertisement</b>	A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.
10-04	<b>Airport</b>	Airport means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft; an appurtenant area used or intended to be used for airport buildings or other airport facilities or rights of way; airport buildings and facilities located in any of these areas, and a heliport.
10-05	<b>Airport Improvement Program (AIP)</b>	A grant-in-aid program, administered by the Federal Aviation Administration (FAA).
10-06	<b>Air Operations Area (AOA)</b>	The term air operations area (AOA) shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.
10-07	<b>Apron</b>	Area where aircraft are parked, unloaded or loaded, fueled and/or serviced.
10-08	<b>ASTM International (ASTM)</b>	Formerly known as the American Society for Testing and Materials (ASTM).
10-09	<b>Award</b>	The Owner's notice to the successful bidder of the acceptance of the submitted bid.
10-10	<b>Bidder</b>	Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.
10-11	<b>Building Area</b>	An area on the airport to be used, considered, or

Paragraph Number	Term	Definition
		intended to be used for airport buildings or other airport facilities or rights-of-way together with all airport buildings and facilities located thereon.
<b>10-12</b>	<b>Calendar Day</b>	Every day shown on the calendar.
<b>10-13</b>	<b>Certificate of Analysis (COA)</b>	The COA is the manufacturer's Certificate of Compliance (COC) including all applicable test results required by the specifications.
<b>10-14</b>	<b>Certificate of Compliance (COC)</b>	The manufacturer's certification stating that materials or assemblies furnished fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer's authorized representative.
<b>10-15</b>	<b>Change Order</b>	A written order to the Contractor covering changes in the plans, specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for work within the scope of the contract and necessary to complete the project.
<b>10-16</b>	<b>Contract</b>	A written agreement between the Owner and the Contractor that establishes the obligations of the parties including but not limited to performance of work, furnishing of labor, equipment and materials and the basis of payment. The awarded contract includes but may not be limited to: Advertisement, Contract form, Proposal, Performance bond, payment bond, General provisions, certifications and representations, Technical Specifications, Plans, Supplemental Provisions, standards incorporated by reference and issued addenda.
<b>10-17</b>	<b>Contract Item (Pay Item)</b>	A specific unit of work for which a price is provided in the contract.
<b>10-18</b>	<b>Contract Time</b>	The number of calendar days or working days, stated in the proposal, allowed for completion of the contract, including authorized time extensions. If a calendar date of completion is stated in the proposal, in lieu of a number of calendar or working days, the contract shall be completed by that date.
<b>10-19</b>	<b>Contractor</b>	The individual, partnership, firm, or corporation primarily liable for the acceptable performance of the work contracted and for the payment of all legal debts pertaining to the work who acts directly or through lawful agents or employees to complete the contract work.
<b>10-20</b>	<b>Contractors Quality</b>	The Contractor's QC facilities in accordance with the



<b>Paragraph Number</b>	<b>Term</b>	<b>Definition</b>
	<b>Control (QC) Facilities</b>	Contractor Quality Control Program (CQCP).
<b>10-21</b>	<b>Contractor Quality Control Program (CQCP)</b>	Details the methods and procedures that will be taken to assure that all materials and completed construction required by the contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors.
<b>10-22</b>	<b>Control Strip</b>	A demonstration by the Contractor that the materials, equipment, and construction processes results in a product meeting the requirements of the specification.
<b>10-23</b>	<b>Construction Safety and Phasing Plan (CSPP)</b>	The overall plan for safety and phasing of a construction project developed by the airport operator or developed by the airport operator's consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.
<b>10-24</b>	<b>Drainage System</b>	The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.
<b>10-25</b>	<b>Engineer</b>	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering, inspection, and/or observation of the contract work and acting directly or through an authorized representative.
<b>10-26</b>	<b>Equipment</b>	All machinery, together with the necessary supplies for upkeep and maintenance; and all tools and apparatus necessary for the proper construction and acceptable completion of the work.
<b>10-27</b>	<b>Extra Work</b>	An item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, but which is found by the Owner's Engineer or Resident Project Representative (RPR) to be necessary to complete the work within the intended scope of the contract as previously modified.
<b>10-28</b>	<b>FAA</b>	The Federal Aviation Administration. When used to designate a person, FAA shall mean the Administrator or their duly authorized representative.
<b>10-29</b>	<b>Federal Specifications</b>	The federal specifications and standards, commercial item descriptions, and supplements, amendments, and indices prepared and issued by the General Services Administration.

<b>Paragraph Number</b>	<b>Term</b>	<b>Definition</b>
<b>10-30</b>	<b>Force Account</b>	<p><b>a.</b> Contract Force Account - A method of payment that addresses extra work performed by the Contractor on a time and material basis.</p> <p><b>b.</b> Owner Force Account - Work performed for the project by the Owner's employees.</p>
<b>10-31</b>	<b>Intention of Terms</b>	<p>Whenever, in these specifications or on the plans, the words “directed,” “required,” “permitted,” “ordered,” “designated,” “prescribed,” or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer and/or Resident Project Representative (RPR) is intended; and similarly, the words “approved,” “acceptable,” “satisfactory,” or words of like import, shall mean approved by, or acceptable to, or satisfactory to the Engineer and/or RPR, subject in each case to the final determination of the Owner.</p> <p>Any reference to a specific requirement of a numbered paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.</p>
<b>10-32</b>	<b>Lighting</b>	A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.
<b>10-33</b>	<b>Major and Minor Contract Items</b>	A major contract item shall be any item that is listed in the proposal, the total cost of which is equal to or greater than 20% of the total amount of the award contract. All other items shall be considered minor contract items.
<b>10-34</b>	<b>Materials</b>	Any substance specified for use in the construction of the contract work.
<b>10-35</b>	<b>Modification of Standards (MOS)</b>	Any deviation from standard specifications applicable to material and construction methods in accordance with FAA Order 5300.1.
<b>10-36</b>	<b>Notice to Proceed (NTP)</b>	A written notice to the Contractor to begin the actual

<b>Paragraph Number</b>	<b>Term</b>	<b>Definition</b>
		contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.
<b>10-37</b>	<b>Owner</b>	The term “Owner” shall mean the party of the first part or the contracting agency signatory to the contract. Where the term “Owner” is capitalized in this document, it shall mean airport Sponsor only. The Owner for this project is the Board of County Commissioners of Washington County, Maryland.
<b>10-38</b>	<b>Passenger Facility Charge (PFC)</b>	Per 14 Code of Federal Regulations (CFR) Part 158 and 49 United States Code (USC) § 40117, a PFC is a charge imposed by a public agency on passengers enplaned at a commercial service airport it controls.
<b>10-39</b>	<b>Pavement Structure</b>	The combined surface course, base course(s), and subbase course(s), if any, considered as a single unit.
<b>10-40</b>	<b>Payment bond</b>	The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will pay in full all bills and accounts for materials and labor used in the construction of the work.
<b>10-41</b>	<b>Performance bond</b>	The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.
<b>10-42</b>	<b>Plans</b>	The official drawings or exact reproductions which show the location, character, dimensions and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications. Plans may also be referred to as 'contract drawings.'
<b>10-43</b>	<b>Project</b>	The agreed scope of work for accomplishing specific airport development with respect to a particular airport.
<b>10-44</b>	<b>Proposal</b>	The written offer of the bidder (when submitted on the approved proposal form) to perform the contemplated work and furnish the necessary materials in accordance with the provisions of the plans and specifications.
<b>10-45</b>	<b>Proposal guaranty</b>	The security furnished with a proposal to guarantee that the bidder will enter into a contract if their own proposal is accepted by the Owner.
<b>10-46</b>	<b>Quality Assurance (QA)</b>	Owner’s responsibility to assure that construction work completed complies with specifications for payment.

<b>Paragraph Number</b>	<b>Term</b>	<b>Definition</b>
<b>10-47</b>	<b>Quality Control (QC)</b>	Contractor's responsibility to control material(s) and construction processes to complete construction in accordance with project specifications.
<b>10-48</b>	<b>Quality Assurance (QA) Inspector</b>	An authorized representative of the Engineer and/or Resident Project Representative (RPR) assigned to make all necessary inspections, observations, tests, and/or observation of tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.
<b>10-49</b>	<b>Quality Assurance (QA) Laboratory</b>	The official quality assurance testing laboratories of the Owner or such other laboratories as may be designated by the Engineer or RPR. May also be referred to as Engineer's, Owner's, or QA Laboratory.
<b>10-50</b>	<b>Resident Project Representative (RPR)</b>	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for all necessary inspections, observations, tests, and/or observations of tests of the contract work performed or being performed, or of the materials furnished or being furnished by the Contractor and acting directly or through an authorized representative. May also be referred to as the Construction Manager, Architect, Engineer or Owner's Representative.
<b>10-51</b>	<b>Runway</b>	The area on the airport prepared for the landing and takeoff of aircraft.
<b>10-52</b>	<b>Runway Safety Area (RSA)</b>	A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft. See the construction safety and phasing plan (CSPP) for limits of the RSA.
<b>10-53</b>	<b>Safety Plan Compliance Document (SPCD)</b>	Details how the Contractor will comply with the CSPP.
<b>10-54</b>	<b>Specifications</b>	A part of the contract containing the written directions and requirements for completing the contract work. Standards for specifying materials or testing which are cited in the contract specifications by reference shall have the same force and effect as if included in the contract physically.
<b>10-55</b>	<b>Sponsor</b>	A Sponsor is defined in 49 USC § 47102(24) as a public agency that submits to the FAA for an AIP grant; or a private Owner of a public-use airport that submits to the FAA an application for an AIP grant for the airport.

<b>Paragraph Number</b>	<b>Term</b>	<b>Definition</b>
<b>10-56</b>	<b>Structures</b>	Airport facilities such as bridges; culverts; catch basins, inlets, retaining walls, cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.
<b>10-57</b>	<b>Subgrade</b>	The soil that forms the pavement foundation.
<b>10-58</b>	<b>Superintendent</b>	The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the RPR, and who shall supervise and direct the construction.
<b>10-59</b>	<b>Supplemental Agreement</b>	A written agreement between the Contractor and the Owner that establishes the basis of payment and contract time adjustment, if any, for the work affected by the supplemental agreement. A supplemental agreement is required if: (1) in scope work would increase or decrease the total amount of the awarded contract by more than 25%; (2) in scope work would increase or decrease the total of any major contract item by more than 25%; (3) work that is not within the scope of the originally awarded contract; or (4) adding or deleting of a major contract item.
<b>10-60</b>	<b>Surety</b>	The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.
<b>10-61</b>	<b>Taxilane</b>	A taxiway designed for low speed movement of aircraft between aircraft parking areas and terminal areas.
<b>10-62</b>	<b>Taxiway</b>	The portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport's runways, aircraft parking areas, and terminal areas.
<b>10-63</b>	<b>Taxiway/Taxilane Safety Area (TSA)</b>	A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an aircraft. See the construction safety and phasing plan (CSPP) for limits of the TSA.
<b>10-64</b>	<b>Work</b>	The furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor's performance of all duties and obligations imposed by the contract, plans, and specifications.

Paragraph Number	Term	Definition
10-65	Working day	A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least six (6) hours toward completion of the contract. When work is suspended for causes beyond the Contractor's control, it will not be counted as a working day. Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work will be considered as working days.
10-66	Owner Defined Terms	Airport Design Consultants, Inc. will act as the Construction Manager (CM) on behalf of the Owner for this contract.

**END OF SECTION 10**

## **Section 20 Proposal Requirements and Conditions**

### **20-01 Advertisement (Notice to Bidders).**

**See Invitation to Bid located at the beginning of the bid book.**

**20-02 Qualification of bidders.** Each bidder shall submit evidence of competency and evidence of financial responsibility to perform the work to the Owner at the time of bid opening.

Evidence of competency, unless otherwise specified, shall consist of statements covering the bidder's past experience on similar work, and a list of equipment and a list of key personnel that would be available for the work.

Each bidder shall furnish the Owner satisfactory evidence of their financial responsibility. Evidence of financial responsibility, unless otherwise specified, shall consist of a confidential statement or report of the bidder's financial resources and liabilities as of the last calendar year or the bidder's last fiscal year. Such statements or reports shall be certified by a public accountant. At the time of submitting such financial statements or reports, the bidder shall further certify whether their financial responsibility is approximately the same as stated or reported by the public accountant. If the bidder's financial responsibility has changed, the bidder shall qualify the public accountant's statement or report to reflect the bidder's true financial condition at the time such qualified statement or report is submitted to the Owner.

Unless otherwise specified, a bidder may submit evidence that they are prequalified with the State Highway Division and are on the current "bidder's list" of the state in which the proposed work is located. Evidence of State Highway Division prequalification may be submitted as evidence of financial responsibility in lieu of the certified statements or reports specified above.

**20-03 Contents of proposal forms.** The Owner's proposal forms state the location and description of the proposed construction; the place, date, and time of opening of the proposals; and the estimated quantities of the various items of work to be performed and materials to be furnished for which unit bid prices are asked. The proposal form states the time in which the work must be completed, and the amount of the proposal guaranty that must accompany the proposal. The Owner will accept only those Proposals properly executed on physical forms or electronic forms provided by the Owner. Bidder actions that may cause the Owner to deem a proposal irregular are given in paragraph 20-09 *Irregular proposals*.

A prebid conference is required on this project to discuss as a minimum, the following items: material requirements; submittals; Quality Control/Quality Assurance requirements; the construction safety and phasing plan including airport access and staging areas. Pre-bid conference will be on Wednesday July 24, 2019 at 1:30 PM in the Hagerstown Regional Airport Conference Room, 18434 Showalter Road, Hagerstown, Maryland.

**20-04 Issuance of proposal forms.** The Owner reserves the right to refuse to issue a proposal form to a prospective bidder if the bidder is in default for any of the following reasons:

- a. Failure to comply with any prequalification regulations of the Owner, if such regulations are cited, or otherwise included, in the proposal as a requirement for bidding.
- b. Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts in force with the Owner at the time the Owner issues the proposal to a prospective bidder.
- c. Documented record of Contractor default under previous contracts with the Owner.
- d. Documented record of unsatisfactory work on previous contracts with the Owner.

**20-05 Interpretation of estimated proposal quantities.** An estimate of quantities of work to be done and materials to be furnished under these specifications is given in the proposal. It is the result of careful calculations and is believed to be correct. It is given only as a basis for comparison of proposals and the award of the contract. The Owner does not expressly, or by implication, agree that the actual quantities involved will correspond exactly therewith; nor shall the bidder plead misunderstanding or deception because of such estimates of quantities, or of the character, location, or other conditions pertaining to the work. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications. It is understood that the quantities may be increased or decreased as provided in the Section 40, paragraph 40-02, Alteration of Work and Quantities, without in any way invalidating the unit bid prices.

**20-06 Examination of plans, specifications, and site.** The bidder is expected to carefully examine the site of the proposed work, the proposal, plans, specifications, and contract forms. Bidders shall satisfy themselves to the character, quality, and quantities of work to be performed, materials to be furnished, and to the requirements of the proposed contract. The submission of a proposal shall be prima facie evidence that the bidder has made such examination and is satisfied to the conditions to be encountered in performing the work and the requirements of the proposed contract, plans, and specifications.

Boring logs and other records of subsurface investigations and tests are available for inspection of bidders. It is understood and agreed that such subsurface information, whether included in the plans, specifications, or otherwise made available to the bidder, was obtained and is intended for the Owner's design and estimating purposes only. Such information has been made available for the convenience of all bidders. It is further understood and agreed that each bidder is solely responsible for all assumptions, deductions, or conclusions which the bidder may make or obtain from their own examination of the boring logs and other records of subsurface investigations and tests that are furnished by the Owner.

**20-07 Preparation of proposal.** The bidder shall submit their proposal on the forms furnished by the Owner. All blank spaces in the proposal forms, unless explicitly stated otherwise, must be correctly filled in where indicated for each and every item for which a quantity is given. The bidder shall state the price (written in ink or typed) both in words and numerals which they propose for each pay item furnished in the proposal. In case of conflict between words and



numerals, the words, unless obviously incorrect, shall govern.

Prices should generally be written in whole dollars and cents. The extended total amount of each item should not be rounded.

The bidder shall correctly sign the proposal in ink. If the proposal is made by an individual, their name and post office address must be shown. If made by a partnership, the name and post office address of each member of the partnership must be shown. If made by a corporation, the person signing the proposal shall give the name of the state where the corporation was chartered and the name, titles, and business address of the president, secretary, and the treasurer. Anyone signing a proposal as an agent shall file evidence of their authority to do so and that the signature is binding upon the firm or corporation.

**20-08 Responsive and responsible bidder.** A responsive bid conforms to all significant terms and conditions contained in the Owner's invitation for bid. It is the Owner's responsibility to decide if the exceptions taken by a bidder to the solicitation are material or not and the extent of deviation it is willing to accept.

A responsible bidder has the ability to perform successfully under the terms and conditions of a proposed procurement, as defined in 2 CFR § 200.318(h). This includes such matters as Contractor integrity, compliance with public policy, record of past performance, and financial and technical resources.

**20-09 Irregular proposals.** Proposals shall be considered irregular for the following reasons:

- a. If the proposal is on a form other than that furnished by the Owner, or if the Owner's form is altered, or if any part of the proposal form is detached.
- b. If there are unauthorized additions, conditional or alternate pay items, or irregularities of any kind that make the proposal incomplete, indefinite, or otherwise ambiguous.
- c. If the proposal does not contain a unit price for each pay item listed in the proposal, except in the case of authorized alternate pay items, for which the bidder is not required to furnish a unit price.
- d. If the proposal contains unit prices that are obviously unbalanced.
- e. If the proposal is not accompanied by the proposal guaranty specified by the Owner.
- f. If the applicable Disadvantaged Business Enterprise information is incomplete.

The Owner reserves the right to reject any irregular proposal and the right to waive technicalities if such waiver is in the best interest of the Owner and conforms to local laws and ordinances pertaining to the letting of construction contracts.

**20-10 Bid guarantee.** Each separate proposal shall be accompanied by a bid bond, certified check, or other specified acceptable collateral, in the amount specified in the proposal form. Such bond, check, or collateral, shall be made payable to the Owner.

The bid guarantee shall be equivalent to 5% of the bid price. It shall consist of a firm commitment such as a bid bond, certified check, or other negotiable instrument accompanying a bid as assurance that the bidder will, upon acceptance of the bid, execute such contractual documents as may be required within the time specified.

**20-11 Delivery of proposal.** Each proposal submitted shall be placed in a sealed envelope plainly marked with the project number, location of airport, and name and business address of the bidder on the outside. When sent by mail, preferably registered, the sealed proposal, marked as indicated above, should be enclosed in an additional envelope. No proposal will be considered unless received at the place specified in the invitation to bid or as modified by Addendum before the time specified for opening all bids. Proposals received after the bid opening time shall be returned to the bidder unopened.

**20-12 Withdrawal or revision of proposals.** A bidder may withdraw or revise (by withdrawal of one proposal and submission of another) a proposal provided that the bidder's request for withdrawal is received by the Owner in writing before the time specified for opening bids. Revised proposals must be received at the place specified in the advertisement before the time specified for opening all bids.

**20-13 Public opening of proposals.** Proposals shall be opened, and read, publicly at the time and place specified in the advertisement. Bidders, their authorized agents, and other interested persons are invited to attend. Proposals that have been withdrawn (by written or telegraphic request) or received after the time specified for opening bids shall be returned to the bidder unopened.

**20-14 Disqualification of bidders.** A bidder shall be considered disqualified for any of the following reasons:

- a. Submitting more than one proposal from the same partnership, firm, or corporation under the same or different name.
- b. Evidence of collusion among bidders. Bidders participating in such collusion shall be disqualified as bidders for any future work of the Owner until any such participating bidder has been reinstated by the Owner as a qualified bidder.
- c. If the bidder is considered to be in "default" for any reason specified in paragraph 20-04, *Issuance of Proposal Forms*, of this section.

**20-15 Discrepancies and Omissions.** A Bidder who discovers discrepancies or omissions with the project bid documents shall immediately notify the Owner of the matter. A bidder that has doubt as to the true meaning of a project requirement may submit to the Owner's Engineer a written request for interpretation no later than the questions cutoff date.

Any interpretation of the project bid documents by the Owner's Engineer will be by written addendum issued by the Owner. The Owner will not consider any instructions, clarifications or interpretations of the bidding documents in any manner other than written addendum.

## END OF SECTION 20

## Section 30 Award and Execution of Contract

**30-01 Consideration of proposals.** After the proposals are publicly opened and read, they will be compared on the basis of the summation of the products obtained by multiplying the estimated quantities shown in the proposal by the unit bid prices. If a bidder's proposal contains a discrepancy between unit bid prices written in words and unit bid prices written in numbers, the unit bid price written in words shall govern.

Until the award of a contract is made, the Owner reserves the right to reject a bidder's proposal for any of the following reasons:

- a. If the proposal is irregular as specified in Section 20, paragraph 20-09, *Irregular Proposals*.
- b. If the bidder is disqualified for any of the reasons specified Section 20, paragraph 20-14, *Disqualification of Bidders*.

In addition, until the award of a contract is made, the Owner reserves the right to reject any or all proposals, waive technicalities, if such waiver is in the best interest of the Owner and is in conformance with applicable state and local laws or regulations pertaining to the letting of construction contracts; advertise for new proposals; or proceed with the work otherwise. All such actions shall promote the Owner's best interests.

**30-02 Award of contract.** The award of a contract, if it is to be awarded, shall be made within 120 calendar days of the date specified for publicly opening proposals, unless otherwise specified herein.

If the Owner elects to proceed with an award of contract, the Owner will make award to the responsible bidder whose bid, conforming with all the material terms and conditions of the bid documents, is the lowest in price.

**30-03 Cancellation of award.** The Owner reserves the right to cancel the award without liability to the bidder, except return of proposal guaranty, at any time before a contract has been fully executed by all parties and is approved by the Owner in accordance with paragraph 30-07 *Approval of Contract*.

**30-04 Return of proposal guaranty.** All proposal guaranties, except those of the two lowest bidders, will be returned immediately after the Owner has made a comparison of bids as specified in the paragraph 30-01, *Consideration of Proposals*. Proposal guaranties of the two lowest bidders will be retained by the Owner until such time as an award is made, at which time, the unsuccessful bidder's proposal guaranty will be returned. The successful bidder's proposal guaranty will be returned as soon as the Owner receives the contract bonds as specified in paragraph 30-05, *Requirements of Contract Bonds*.

**30-05 Requirements of contract bonds.** At the time of the execution of the contract, the

successful bidder shall furnish the Owner a surety bond or bonds that have been fully executed by the bidder and the surety guaranteeing the performance of the work and the payment of all legal debts that may be incurred by reason of the Contractor's performance of the work. The surety and the form of the bond or bonds shall be acceptable to the Owner. Unless otherwise specified in this subsection, the surety bond or bonds shall be in a sum equal to the full amount of the contract.

**30-06 Execution of contract.** The successful bidder shall sign (execute) the necessary agreements for entering into the contract and return the signed contract to the Owner, along with the fully executed surety bond or bonds specified in paragraph 30-05, *Requirements of Contract Bonds*, of this section, within 15 calendar days from the date mailed or otherwise delivered to the successful bidder.

**30-07 Approval of contract.** Upon receipt of the contract and contract bond or bonds that have been executed by the successful bidder, the Owner shall complete the execution of the contract in accordance with local laws or ordinances, and return the fully executed contract to the Contractor. Delivery of the fully executed contract to the Contractor shall constitute the Owner's approval to be bound by the successful bidder's proposal and the terms of the contract.

**30-08 Failure to execute contract.** Failure of the successful bidder to execute the contract and furnish an acceptable surety bond or bonds within the period specified in paragraph 30-06, *Execution of Contract*, of this section shall be just cause for cancellation of the award and forfeiture of the proposal guaranty, not as a penalty, but as liquidated damages to the Owner.

## END OF SECTION 30

## Section 40 Scope of Work

**40-01 Intent of contract.** The intent of the contract is to provide for construction and completion, in every detail, of the work described. It is further intended that the Contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the plans, specifications, and terms of the contract.

**40-02 Alteration of work and quantities.** The Owner reserves the right to make such changes in quantities and work as may be necessary or desirable to complete, in a satisfactory manner, the original intended work. Unless otherwise specified in the Contract, the Owner's Engineer or RPR shall be and is hereby authorized to make, in writing, such in-scope alterations in the work and variation of quantities as may be necessary to complete the work, provided such action does not represent a significant change in the character of the work.

For purpose of this section, a significant change in character of work means: any change that is outside the current contract scope of work; any change (increase or decrease) in the total contract cost by more than 25%; or any change in the total cost of a major contract item by more than 25%.

Work alterations and quantity variances that do not meet the definition of significant change in character of work shall not invalidate the contract nor release the surety. Contractor agrees to accept payment for such work alterations and quantity variances in accordance with Section 90, paragraph 90-03, *Compensation for Altered Quantities*.

Should the value of altered work or quantity variance meet the criteria for significant change in character of work, such altered work and quantity variance shall be covered by a supplemental agreement. Supplemental agreements shall also require consent of the Contractor's surety and separate performance and payment bonds. If the Owner and the Contractor are unable to agree on a unit adjustment for any contract item that requires a supplemental agreement, the Owner reserves the right to terminate the contract with respect to the item and make other arrangements for its completion.

**40-03 Omitted items.** The Owner, the Owner's Engineer or the RPR may provide written notice to the Contractor to omit from the work any contract item that does not meet the definition of major contract item. Major contract items may be omitted by a supplemental agreement. Such omission of contract items shall not invalidate any other contract provision or requirement.

Should a contract item be omitted or otherwise ordered to be non-performed, the Contractor shall be paid for all work performed toward completion of such item prior to the date of the order to omit such item. Payment for work performed shall be in accordance with Section 90, paragraph 90-04, *Payment for Omitted Items*.

**40-04 Extra work.** Should acceptable completion of the contract require the Contractor to perform an item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, Owner may issue a Change Order to cover the necessary extra work.

Change orders for extra work shall contain agreed unit prices for performing the change order work in accordance with the requirements specified in the order, and shall contain any adjustment to the contract time that, in the RPR's opinion, is necessary for completion of the extra work.

When determined by the RPR to be in the Owner's best interest, the RPR may order the Contractor to proceed with extra work as provided in Section 90, paragraph 90-05, *Payment for Extra Work*. Extra work that is necessary for acceptable completion of the project, but is not within the general scope of the work covered by the original contract shall be covered by a supplemental agreement as defined in Section 10, paragraph 10-59, *Supplemental Agreement*.

If extra work is essential to maintaining the project critical path, RPR may order the Contractor to commence the extra work under a Time and Material contract method. Once sufficient detail is available to establish the level of effort necessary for the extra work, the Owner shall initiate a change order or supplemental agreement to cover the extra work.

Any claim for payment of extra work that is not covered by written agreement (change order or supplemental agreement) shall be rejected by the Owner.

All change orders, supplemental agreements, and contract modifications must eventually be reviewed by the FAA. Unless specifically requested by the FAA, the Owner does not have to obtain prior FAA approval for contract changes except for the Buy American review, if required. However, if an Owner proceeds with contract changes without FAA approval, it is at the Owner's risk.

**40-05 Maintenance of traffic.** It is the explicit intention of the contract that the safety of aircraft, as well as the Contractor's equipment and personnel, is the most important consideration. The Contractor shall maintain traffic in the manner detailed in the Construction Safety and Phasing Plan (CSPP).

**a.** It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas (AOAs) of the airport with respect to their own operations and the operations of all subcontractors as specified in Section 80, paragraph 80-04, *Limitation of Operations*. It is further understood and agreed that the Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, from, and upon the airport as specified in Section 70, paragraph 70-15, *Contractor's Responsibility for Utility Service and Facilities of Others*.

**b.** With respect to their own operations and the operations of all subcontractors, the Contractor shall provide marking, lighting, and other acceptable means of identifying personnel, equipment, vehicles, storage areas, and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport in accordance with the construction safety and phasing plan (CSPP) and the safety plan compliance document (SPCD).

Refer to AC 150/5210-5, Painting, Marking and Lighting of Vehicles Used on an Airport and AC 150/5370-2, Operational Safety on Airports During Construction for applicable standards.

c. When the contract requires the maintenance of an existing road, street, or highway during the Contractor's performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep the road, street, or highway open to all traffic and shall provide maintenance as may be required to accommodate traffic. The Contractor, at their expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor's equipment and personnel. The Contractor shall furnish, erect, and maintain barricades, warning signs, flag person, and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices (MUTCD) (<http://mutcd.fhwa.dot.gov/>), unless otherwise specified. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways. Unless otherwise specified herein, the Contractor will not be required to furnish snow removal for such existing road, street, or highway.

**40-06 Removal of existing structures.** All existing structures encountered within the established lines, grades, or grading sections shall be removed by the Contractor, unless such existing structures are otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the work or to remain in place. The cost of removing such existing structures shall not be measured or paid for directly, but shall be included in the various contract items.

Should the Contractor encounter an existing structure (above or below ground) in the work for which the disposition is not indicated on the plans, the Resident Project Representative (RPR) shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the RPR in accordance with the provisions of the contract.

Except as provided in Section 40, paragraph 40-07, *Rights in and Use of Materials Found in the Work*, it is intended that all existing materials or structures that may be encountered (within the lines, grades, or grading sections established for completion of the work) shall be used in the work as otherwise provided for in the contract and shall remain the property of the Owner when so used in the work.

The removal of large or complicated existing structures such as box-culverts, underground storage tanks, large underground electrical vaults, large reinforced concrete structures or foundations, or similar existing airport facilities should be provided for in separate technical specifications. Contract pay items should also be provided in the contract proposal to cover payment for such work.

**40-07 Rights in and use of materials found in the work.** Should the Contractor encounter any material such as (but not restricted to) sand, stone, gravel, slag, or concrete slabs within the established lines, grades, or grading sections, the use of which is intended by the terms of the contract to be embankment, the Contractor may at their own option either:

- a. Use such material in another contract item, providing such use is approved by the RPR and is in conformance with the contract specifications applicable to such use; or,

- b. Remove such material from the site, upon written approval of the RPR; or
- c. Use such material for the Contractor's own temporary construction on site; or,
- d. Use such material as intended by the terms of the contract.

Should the Contractor wish to exercise option a., b., or c., the Contractor shall request the RPR's approval in advance of such use.

Should the RPR approve the Contractor's request to exercise option a., b., or c., the Contractor shall be paid for the excavation or removal of such material at the applicable contract price. The Contractor shall replace, at their expense, such removed or excavated material with an agreed equal volume of material that is acceptable for use in constructing embankment, backfills, or otherwise to the extent that such replacement material is needed to complete the contract work. The Contractor shall not be charged for use of such material used in the work or removed from the site.

Should the RPR approve the Contractor's exercise of option a., the Contractor shall be paid, at the applicable contract price, for furnishing and installing such material in accordance with requirements of the contract item in which the material is used.

It is understood and agreed that the Contractor shall make no claim for delays by reason of their own exercise of option a., b., or c.

The Contractor shall not excavate, remove, or otherwise disturb any material, structure, or part of a structure which is located outside the lines, grades, or grading sections established for the work, except where such excavation or removal is provided for in the contract, plans, or specifications.

**40-08 Final cleanup.** Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. The Contractor shall cut all brush and woods within the limits indicated and shall leave the site in a neat and presentable condition. Material cleared from the site and deposited on adjacent property will not be considered as having been disposed of satisfactorily, unless the Contractor has obtained the written permission of the property Owner.

#### END OF SECTION 40



## Section 50 Control of Work

**50-01 Authority of the Resident Project Representative (RPR).** The RPR has final authority regarding the interpretation of project specification requirements. The RPR shall determine acceptability of the quality of materials furnished, method of performance of work performed, and the manner and rate of performance of the work. The RPR does not have the authority to accept work that does not conform to specification requirements.

**50-02 Conformity with plans and specifications.** All work and all materials furnished shall be in reasonably close conformity with the lines, grades, grading sections, cross-sections, dimensions, material requirements, and testing requirements that are specified (including specified tolerances) in the contract, plans, or specifications.

If the RPR finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications, but that the portion of the work affected will, in their opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, the RPR will advise the Owner of their determination that the affected work be accepted and remain in place. The RPR will document the determination and recommend to the Owner a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. Changes in the contract price must be covered by contract change order or supplemental agreement as applicable.

If the RPR finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the RPR's written orders.

The term "reasonably close conformity" shall not be construed as waiving the Contractor's responsibility to complete the work in accordance with the contract, plans, and specifications. The term shall not be construed as waiving the RPR's responsibility to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor's execution of the work, when, in the RPR's opinion, such compliance is essential to provide an acceptable finished portion of the work.

The term "reasonably close conformity" is also intended to provide the RPR with the authority, after consultation with the Sponsor and FAA, to use sound engineering judgment in their determinations to accept work that is not in strict conformity, but will provide a finished product equal to or better than that required by the requirements of the contract, plans and specifications.

The RPR will not be responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto.

**50-03 Coordination of contract, plans, and specifications.** The contract, plans, specifications, and all referenced standards cited are essential parts of the contract requirements. If electronic files are provided and used on the project and there is a conflict between the electronic files and hard copy plans, the hard copy plans shall govern. A requirement occurring in one is as binding

as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, calculated dimensions will govern over scaled dimensions; contract technical specifications shall govern over contract general provisions, plans, cited standards for materials or testing, and cited advisory circulars (ACs); contract general provisions shall govern over plans, cited standards for materials or testing, and cited ACs; plans shall govern over cited standards for materials or testing and cited ACs. If any paragraphs contained in the General Conditions, Supplemental Terms and Conditions and Special Provisions conflict with General Provisions or Technical Specifications, the General Conditions, Supplemental Terms and Conditions and Special Provisions shall govern.

From time to time, discrepancies within cited testing standards occur due to the timing of the change, edits, and/or replacement of the standards. If the Contractor discovers any apparent discrepancy within standard test methods, the Contractor shall immediately ask the RPR for an interpretation and decision, and such decision shall be final.

The Contractor shall not take advantage of any apparent error or omission on the plans or specifications. In the event the Contractor discovers any apparent error or discrepancy, Contractor shall immediately notify the Owner or the designated representative in writing requesting their written interpretation and decision.

**50-04 List of Special Provisions. Not Used.**

**50-05 Cooperation of Contractor.** The Contractor shall be supplied with five hard copies or an electronic PDF of the plans and specifications. The Contractor shall have available on the construction site at all times one hardcopy each of the plans and specifications. Additional hard copies of plans and specifications may be obtained by the Contractor for the cost of reproduction.

The Contractor shall give constant attention to the work to facilitate the progress thereof, and shall cooperate with the RPR and their inspectors and with other Contractors in every way possible. The Contractor shall have a competent superintendent on the work at all times who is fully authorized as their agent on the work. The superintendent shall be capable of reading and thoroughly understanding the plans and specifications and shall receive and fulfill instructions from the RPR or their authorized representative.

**50-06 Cooperation between Contractors.** The Owner reserves the right to contract for and perform other or additional work on or near the work covered by this contract.

When separate contracts are let within the limits of any one project, each Contractor shall conduct the work not to interfere with or hinder the progress of completion of the work being performed by other Contractors. Contractors working on the same project shall cooperate with each other as directed.

Each Contractor involved shall assume all liability, financial or otherwise, in connection with their own contract and shall protect and hold harmless the Owner from any and all damages or claims that may arise because of inconvenience, delays, or loss experienced because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange their work and shall place and dispose of the materials being used to not interfere with the operations of the other Contractors within the limits of the same project. The Contractor shall join their work with that of the others in an acceptable manner and shall

perform it in proper sequence to that of the others.

**50-07 Construction layout and stakes.** The Engineer/RPR shall establish necessary horizontal and vertical control. The establishment of Survey Control and/or reestablishment of survey control shall be by a State Licensed Land Surveyor. Contractor is responsible for preserving integrity of horizontal and vertical controls established by Engineer/RPR. In case of negligence on the part of the Contractor or their employees, resulting in the destruction of any horizontal and vertical control, the resulting costs will be deducted as a liquidated damage against the Contractor.

Prior to the start of construction, the Contractor will check all control points for horizontal and vertical accuracy and certify in writing to the RPR that the Contractor concurs with survey control established for the project. All lines, grades and measurements from control points necessary for the proper execution and control of the work on this project will be provided to the RPR. The Contractor is responsible to establish all layout required for the construction of the project.

Copies of survey notes will be provided to the RPR for each area of construction and for each placement of material as specified to allow the RPR to make periodic checks for conformance with plan grades, alignments and grade tolerances required by the applicable material specifications. Surveys will be provided to the RPR prior to commencing work items that cover or disturb the survey staking. Survey(s) and notes shall be provided in the following format(s): LandXML, AutoCAD .dwg file format (2018) and PDF.

Laser, GPS, String line, or other automatic control shall be checked with temporary control as necessary. In the case of error, on the part of the Contractor, their surveyor, employees or subcontractors, resulting in established grades, alignment or grade tolerances that do not concur with those specified or shown on the plans, the Contractor is solely responsible for correction, removal, replacement and all associated costs at no additional cost to the Owner.

No direct payment will be made, unless otherwise specified in contract documents, for this labor, materials, or other expenses. The cost shall be included in the price of the bid for the various items of the Contract.

**50-08 Authority and duties of Quality Assurance (QA) inspectors.** QA inspectors shall be authorized to inspect all work done and all material furnished. Such QA inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. QA inspectors are not authorized to revoke, alter, or waive any provision of the contract. QA inspectors are not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.

QA Inspectors are authorized to notify the Contractor or their representatives of any failure of the work or materials to conform to the requirements of the contract, plans, or specifications and to reject such nonconforming materials in question until such issues can be referred to the RPR for a decision.

**50-09 Inspection of the work.** All materials and each part or detail of the work shall be subject to inspection. The RPR shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

If the RPR requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be at the Contractor's expense.

Provide advance written notice to the RPR of work the Contractor plans to perform each week and each day. Any work done or materials used without written notice and allowing opportunity for inspection by the RPR may be ordered removed and replaced at the Contractor's expense.

Should the contract work include relocation, adjustment, or any other modification to existing facilities, not the property of the (contract) Owner, authorized representatives of the Owners of such facilities shall have the right to inspect such work. Such inspection shall in no sense make any facility owner a party to the contract, and shall in no way interfere with the rights of the parties to this contract.

**50-10 Removal of unacceptable and unauthorized work.** All work that does not conform to the requirements of the contract, plans, and specifications will be considered unacceptable, unless otherwise determined acceptable by the RPR as provided in paragraph 50-02, *Conformity with Plans and Specifications*.

Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner in accordance with the provisions of Section 70, paragraph 70-14, *Contractor's Responsibility for Work*.

No removal work made under provision of this paragraph shall be done without lines and grades having been established by the RPR. Work done contrary to the instructions of the RPR, work done beyond the lines shown on the plans or as established by the RPR, except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at the Contractor's expense.

Upon failure on the part of the Contractor to comply with any order of the RPR made under the provisions of this subsection, the RPR will have authority to cause unacceptable work to be remedied or removed and replaced; and unauthorized work to be removed and recover the resulting costs as a liquidated damage against the Contractor.

**50-11 Load restrictions.** The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the work. A special permit will not relieve the Contractor of liability for damage that may result from the moving of material or equipment.

The operation of equipment of such weight or so loaded as to cause damage to structures or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete pavement, base, or structure before the expiration of the curing period. The Contractor,

at their own expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor's equipment and personnel.

**50-12 Maintenance during construction.** The Contractor shall maintain the work during construction and until the work is accepted. Maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces so that the work is maintained in satisfactory condition at all times.

In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

All costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various contract items, and the Contractor will not be paid an additional amount for such work.

**50-13 Failure to maintain the work.** Should the Contractor at any time fail to maintain the work as provided in paragraph 50-12, *Maintenance during Construction*, the RPR shall immediately notify the Contractor of such noncompliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. The time specified will give due consideration to the exigency that exists.

Should the Contractor fail to respond to the RPR's notification, the Owner may suspend any work necessary for the Owner to correct such unsatisfactory maintenance condition, depending on the exigency that exists. Any maintenance cost incurred by the Owner, shall be recovered as a liquidated damage against the Contractor.

**50-14 Partial acceptance.** If at any time during the execution of the project the Contractor substantially completes a usable unit or portion of the work, the occupancy of which will benefit the Owner, the Contractor may request the RPR to make final inspection of that unit. If the RPR finds upon inspection that the unit has been satisfactorily completed in compliance with the contract, the RPR may accept it as being complete, and the Contractor may be relieved of further responsibility for that unit. Such partial acceptance and beneficial occupancy by the Owner shall not void or alter any provision of the contract.

**50-15 Final acceptance.** Upon due notice from the Contractor of presumptive completion of the entire project, the RPR and Owner will make an inspection. If all construction provided for and contemplated by the contract is found to be complete in accordance with the contract, plans, and specifications, such inspection shall constitute the final inspection. The RPR shall notify the Contractor in writing of final acceptance as of the date of the final inspection.

If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the RPR will notify the Contractor and the Contractor shall correct the unsatisfactory work. Upon correction of the work, another inspection will be made which shall constitute the final inspection, provided the work has been satisfactorily completed. In such event, the RPR will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

**50-16 Claims for adjustment and disputes.** If for any reason the Contractor deems that additional compensation is due for work or materials not clearly provided for in the contract,

plans, or specifications or previously authorized as extra work, the Contractor shall notify the RPR in writing of their intention to claim such additional compensation before the Contractor begins the work on which the Contractor bases the claim. If such notification is not given or the RPR is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the RPR has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit a written claim to the RPR who will present it to the Owner for consideration in accordance with local laws or ordinances.

Nothing in this subsection shall be construed as a waiver of the Contractor's right to dispute final payment based on differences in measurements or computations.

**50-17 Value Engineering Cost Proposal. Not Used.**

**END OF SECTION 50**

## Section 60 Control of Materials

**60-01 Source of supply and quality requirements.** The materials used in the work shall conform to the requirements of the contract, plans, and specifications. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed).

In order to expedite the inspection and testing of materials, the Contractor shall furnish documentation to the RPR as to the origin, composition, and manufacture of all materials to be used in the work. Documentation shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

At the RPR's option, materials may be approved at the source of supply before delivery. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

**60-02 Samples, tests, and cited specifications.** All materials used in the work shall be inspected, tested, and approved by the RPR before incorporation in the work unless otherwise designated. Any work in which untested materials are used without approval or written permission of the RPR shall be performed at the Contractor's risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the RPR, shall be removed at the Contractor's expense.

Unless otherwise designated, quality assurance tests will be made by and at the expense of the Owner in accordance with the cited standard methods of ASTM, American Association of State Highway and Transportation Officials (AASHTO), federal specifications, Commercial Item Descriptions, and all other cited methods, which are current on the date of advertisement for bids.

The testing organizations performing on-site quality assurance field tests shall have copies of all referenced standards on the construction site for use by all technicians and other personnel. Unless otherwise designated, samples for quality assurance will be taken by a qualified representative of the RPR. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor's representative at their request after review and approval of the RPR.

**60-03 Certification of compliance/analysis (COC/COA).** The RPR may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer's COC stating that such materials or assemblies fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer. Each lot of such materials or assemblies delivered to the work must be accompanied by a certificate of compliance in which the lot is clearly identified. The COA is the manufacturer's COC and includes all applicable test results.

Materials or assemblies used on the basis of certificates of compliance may be sampled and tested at any time and if found not to be in conformity with contract requirements will be subject to rejection whether in place or not.

The form and distribution of certificates of compliance shall be as approved by the RPR. When a material or assembly is specified by "brand name or equal" and the Contractor elects to

furnish the specified “or equal,” the Contractor shall be required to furnish the manufacturer’s certificate of compliance for each lot of such material or assembly delivered to the work. Such certificate of compliance shall clearly identify each lot delivered and shall certify as to:

- a. Conformance to the specified performance, testing, quality or dimensional requirements; and,
- b. Suitability of the material or assembly for the use intended in the contract work.

The RPR shall be the sole judge as to whether the proposed “or equal” is suitable for use in the work.

The RPR reserves the right to refuse permission for use of materials or assemblies on the basis of certificates of compliance.

**60-04 Plant inspection.** Not used.

**60-05 Engineer/ Resident Project Representative (RPR) field office.** Not used.

**60-06 Storage of materials.** Materials shall be stored to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the RPR. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans and/or CSPP, the storage of materials and the location of the Contractor’s plant and parked equipment or vehicles shall be as directed by the RPR. Private property shall not be used for storage purposes without written permission of the Owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for the storage of materials on private property. Upon request, the Contractor shall furnish the RPR a copy of the property Owner’s permission.

All storage sites on private or airport property shall be restored to their original condition by the Contractor at their expense, except as otherwise agreed to (in writing) by the Owner or lessee of the property.

**60-07 Unacceptable materials.** Any material or assembly that does not conform to the requirements of the contract, plans, or specifications shall be considered unacceptable and shall be rejected. The Contractor shall remove any rejected material or assembly from the site of the work, unless otherwise instructed by the RPR.

Rejected material or assembly, the defects of which have been corrected by the Contractor, shall not be returned to the site of the work until such time as the RPR has approved its use in the work.

**60-08 Owner furnished materials.** Not used.

## END OF SECTION 60



## Section 70 Legal Regulations and Responsibility to Public

**70-01 Laws to be observed.** The Contractor shall keep fully informed of all federal and state laws, all local laws, ordinances, and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the Owner and all their officers, agents, or servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or the Contractor's employees.

**70-02 Permits, licenses, and taxes.** The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful execution of the work.

**70-03 Patented devices, materials, and processes.** If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the Patentee or Owner. The Contractor and the surety shall indemnify and hold harmless the Owner, any third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which it may be obliged to pay by reason of an infringement, at any time during the execution or after the completion of the work.

**70-04 Restoration of surfaces disturbed by others.** The Owner reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, FAA or National Oceanic and Atmospheric Administration (NOAA) facility, or a utility service of another government agency at any time during the progress of the work. To the extent that such construction, reconstruction, or maintenance has been coordinated with the Owner, such authorized work (by others) must be shown on the plans and is indicated as follows:

UTILITY	OWNER	PLAN SHEET	CONTACT
Power			
Gas			
Telecommunications			
FAA Facilities			

Except as listed above, the Contractor shall not permit any individual, firm, or corporation to excavate or otherwise disturb such utility services or facilities located within the limits of the work without the written permission of the RPR.

Should the Owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such Owners by arranging and performing the work in this contract to facilitate such construction, reconstruction or

maintenance by others whether or not such work by others is listed above. When ordered as extra work by the RPR, the Contractor shall make all necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work.

**70-05 Federal Participation.** The United States Government has agreed to reimburse the Owner for some portion of the contract costs. The contract work is subject to the inspection and approval of duly authorized representatives of the FAA Administrator. No requirement of this contract shall be construed as making the United States a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract.

**70-06 Sanitary, health, and safety provisions.** The Contractor's worksite and facilities shall comply with applicable federal, state, and local requirements for health, safety and sanitary provisions.

**70-07 Public convenience and safety.** The Contractor shall control their operations and those of their subcontractors and all suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

The Contractor shall maintain the free and unobstructed movement of aircraft and vehicular traffic with respect to their own operations and those of their own subcontractors and all suppliers in accordance with Section 40, paragraph 40-05, *Maintenance of Traffic*, and shall limit such operations for the convenience and safety of the traveling public as specified in Section 80, paragraph 80-04, *Limitation of Operations*.

The Contractor shall remove or control debris and rubbish resulting from its work operations at frequent intervals, and upon the order of the RPR. If the RPR determines the existence of Contractor debris in the work site represents a hazard to airport operations and the Contractor is unable to respond in a prompt and reasonable manner, the RPR reserves the right to assign the task of debris removal to a third party and recover the resulting costs as a liquidated damage against the Contractor.

**70-08 Construction Safety and Phasing Plan (CSPP).** The Contractor shall complete the work in accordance with the approved Construction Safety and Phasing Plan (CSPP) developed in accordance with AC 150/5370-2, Operational Safety on Airports During Construction.

**70-09 Use of explosives.** When the use of explosives is necessary for the execution of the work, the Contractor shall exercise the utmost care not to endanger life or property, including new work. The Contractor shall be responsible for all damage resulting from the use of explosives.

All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided satisfactory to the RPR and, in general, not closer than 1,000 feet (300 m) from the work or from any building, road, or other place of human occupancy.

The Contractor shall notify each property Owner and public utility company having structures or facilities in proximity to the site of the work of their intention to use explosives. Such notice shall be given sufficiently in advance to enable them to take such steps as they may deem necessary to protect their property from injury.

The use of electrical blasting caps shall not be permitted on or within 1,000 feet (300 m) of the airport property.

**70-10 Protection and restoration of property and landscape.** The Contractor shall be responsible for the preservation of all public and private property, and shall protect carefully from disturbance or damage all land monuments and property markers until the Engineer/RPR has witnessed or otherwise referenced their location and shall not move them until directed.

The Contractor shall be responsible for all damage or injury to property of any character, during the execution of the work, resulting from any act, omission, neglect, or misconduct in manner or method of executing the work, or at any time due to defective work or materials, and said responsibility shall not be released until the project has been completed and accepted.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof by the Contractor, the Contractor shall restore, at their expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner.

**70-11 Responsibility for damage claims.** The Contractor shall indemnify and hold harmless the Engineer/RPR and the Owner and their officers, agents, and employees from all suits, actions, or claims, of any character, brought because of any injuries or damage received or sustained by any person, persons, or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the "Workmen's Compensation Act," or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of their own contract considered necessary by the Owner for such purpose may be retained for the use of the Owner or, in case no money is due, their own surety may be held until such suits, actions, or claims for injuries or damages shall have been settled and suitable evidence to that effect furnished to the Owner, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that he or she is adequately protected by public liability and property damage insurance.

**70-12 Third party beneficiary clause.** It is specifically agreed between the parties executing the contract that it is not intended by any of the provisions of any part of the contract to create for the public or any member thereof, a third-party beneficiary or to authorize anyone not a party to the contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the contract.

**70-13 Opening sections of the work to traffic.** If it is necessary for the Contractor to complete portions of the contract work for the beneficial occupancy of the Owner prior to completion of the entire contract, such "phasing" of the work must be specified below and indicated on the approved Construction Safety and Phasing Plan (CSPP) and the project plans. When so specified, the Contractor shall complete such portions of the work on or before the date specified or as otherwise specified.

Upon completion of any portion of work listed above, such portion shall be accepted by the Owner in accordance with Section 50, paragraph 50-14, *Partial Acceptance*.

No portion of the work may be opened by the Contractor until directed by the Owner in writing. Should it become necessary to open a portion of the work to traffic on a temporary or intermittent basis, such openings shall be made when, in the opinion of the RPR, such portion of the work is in an acceptable condition to support the intended traffic. Temporary or intermittent openings are considered to be inherent in the work and shall not constitute either acceptance of the portion of the work so opened or a waiver of any provision of the contract. Any damage to the portion of the work so opened that is not attributable to traffic which is permitted by the Owner shall be repaired by the Contractor at their expense.

The Contractor shall make their own estimate of the inherent difficulties involved in completing the work under the conditions herein described and shall not claim any added compensation by reason of delay or increased cost due to opening a portion of the contract work.

The Contractor must conform to safety standards contained AC 150/5370-2 and the approved CSPP.

**70-14 Contractor's responsibility for work.** Until the RPR's final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with Section 50, paragraph 50-14, *Partial Acceptance*, the Contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part due to the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance and shall bear the expense thereof except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including but not restricted to acts of God such as earthquake, tidal wave, tornado, hurricane or other cataclysmic phenomenon of nature, or acts of the public enemy or of government authorities.

If the work is suspended for any cause whatever, the Contractor shall be responsible for the work and shall take such precautions necessary to prevent damage to the work. The Contractor shall provide for normal drainage and shall erect necessary temporary structures, signs, or other facilities at their own expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established planting, seeding, and sodding furnished under the contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

**70-15 Contractor's responsibility for utility service and facilities of others.** As provided in paragraph 70-04, *Restoration of Surfaces Disturbed by Others*, the Contractor shall cooperate with the owner of any public or private utility service, FAA or NOAA, or a utility service of another government agency that may be authorized by the Owner to construct, reconstruct or maintain such utility services or facilities during the progress of the work. In addition, the Contractor shall control their operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans and/or in the contract documents.

<u>Utility Service or Facility</u>	<u>Person to Contact</u>	<u>Contact</u>
FAA – Martinsburg SSC	Mr. Mark Hayman	540-521-1622
Miss Utility		1-800-257-7777

It is understood and agreed that the Owner does not guarantee the accuracy or the completeness of the location information relating to existing utility services, facilities, or structures that may be shown on the plans or encountered in the work. Any inaccuracy or omission in such information shall not relieve the Contractor of the responsibility to protect such existing features from damage or unscheduled interruption of service.

It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the Owners of all utility services or other facilities of their plan of operations. Such notification shall be in writing addressed to “The Person to Contact” as provided in this paragraph and paragraph 70-04, *Restoration of Surfaces Disturbed By Others*. A copy of each notification shall be given to the RPR.

In addition to the general written notification provided, it shall be the responsibility of the Contractor to keep such individual Owners advised of changes in their plan of operations that would affect such Owners.

Prior to beginning the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such Owner of their plan of operation. If, in the Contractor’s opinion, the Owner’s assistance is needed to locate the utility service or facility or the presence of a representative of the Owner is desirable to observe the work, such advice should be included in the notification. Such notification shall be given by the most expeditious means to reach the utility owner’s “Person to Contact” no later than two normal business days prior to the Contractor’s commencement of operations in such general vicinity. The Contractor shall furnish a written summary of the notification to the RPR.

The Contractor’s failure to give the two days’ notice shall be cause for the Owner to suspend the Contractor’s operations in the general vicinity of a utility service or facility.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use hand excavation methods within 3 feet (1 m) of such outside limits at such points as may be required to ensure protection from damage due to the Contractor’s operations.

Should the Contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, the Contractor shall immediately notify the proper authority and the RPR and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility owner and the RPR continuously until such damage has been repaired and service restored to the satisfaction of the utility or facility owner.

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to their operations whether due to negligence or accident. The Owner reserves the right to deduct such costs from any monies due or which may become due the Contractor, or their own surety.

**70-15.1 FAA facilities and cable runs.** Not Used.

**70-16 Furnishing rights-of-way.** Not used.

**70-17 Personal liability of public officials.** In carrying out any of the contract provisions or in exercising any power or authority granted by this contract, there shall be no liability upon the Engineer, RPR, their authorized representatives, or any officials of the Owner either personally or as an official of the Owner. It is understood that in such matters they act solely as agents and representatives of the Owner.

**70-18 No waiver of legal rights.** Upon completion of the work, the Owner will expeditiously make final inspection and notify the Contractor of final acceptance. Such final acceptance, however, shall not preclude or stop the Owner from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the Owner be precluded or stopped from recovering from the Contractor or their surety, or both, such overpayment as may be sustained, or by failure on the part of the Contractor to fulfill their obligations under the contract. A waiver on the part of the Owner of any breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach.

The Contractor, without prejudice to the terms of the contract, shall be liable to the Owner for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Owner's rights under any warranty or guaranty.

**70-19 Environmental protection.** The Contractor shall comply with all federal, state, and local laws and regulations controlling pollution of the environment. The Contractor shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, asphalts, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

**70-20 Archaeological and historical findings.** Unless otherwise specified in this subsection, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

Should the Contractor encounter, during their operations, any building, part of a building, structure, or object that is incongruous with its surroundings, the Contractor shall immediately cease operations in that location and notify the RPR. The RPR will immediately investigate the Contractor's finding and the Owner will direct the Contractor to either resume operations or to suspend operations as directed.

Should the Owner order suspension of the Contractor's operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract change order or supplemental agreement as provided in Section 40, paragraph 40-04, *Extra Work*, and Section 90, paragraph 90-05, *Payment for Extra Work*. If appropriate, the contract change order or supplemental agreement shall include an extension of contract time in accordance with Section 80, paragraph 80-07, *Determination and Extension of Contract Time*.

**70-21 Insurance Requirements.** See *Washington County's Insurance Requirements for Independent Contractors Policy* located in Section 1 of the Project Manual.

## END OF SECTION 70

## Section 80 Execution and Progress

**80-01 Subletting of contract.** The Owner will not recognize any subcontractor on the work. The Contractor shall at all times when work is in progress be represented either in person, by a qualified superintendent, or by other designated, qualified representative who is duly authorized to receive and execute orders of the Resident Project Representative (RPR).

The Contractor shall perform, with his organization, an amount of work equal to at least 25% percent of the total contract cost.

Should the Contractor elect to assign their contract, said assignment shall be concurred in by the surety, shall be presented for the consideration and approval of the Owner, and shall be consummated only on the written approval of the Owner.

**The Contractor shall provide copies of all subcontracts to the RPR 14 days prior to being utilized on the project. As a minimum, the information shall include the following:**

- Subcontractor's legal company name.
- Subcontractor's legal company address, including County name.
- Principal contact person's name, telephone and fax number.
- Complete narrative description, and dollar value of the work to be performed by the subcontractor.
- Copies of required insurance certificates in accordance with the specifications.
- Minority/ non-minority status.

**80-02 Notice to proceed (NTP).** The Owners notice to proceed will state the date on which contract time commences. The Contractor is expected to commence project operations within 10 days of the NTP date. The Contractor shall notify the RPR at least 24 hours in advance of the time contract operations begins. The Contractor shall not commence any actual operations prior to the date on which the notice to proceed is issued by the Owner.

**80-03 Execution and progress.** Unless otherwise specified, the Contractor shall submit their coordinated construction schedule showing all work activities for the RPR's review and acceptance at least 10 days prior to the start of work. The Contractor's progress schedule, once accepted by the RPR, will represent the Contractor's baseline plan to accomplish the project in accordance with the terms and conditions of the Contract. The RPR will compare actual Contractor progress against the baseline schedule to determine that status of the Contractor's performance. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the project in accordance with the plans and specifications within the time set forth in the proposal.

If the Contractor falls significantly behind the submitted schedule, the Contractor shall, upon the RPR's request, submit a revised schedule for completion of the work within the contract time and modify their operations to provide such additional materials, equipment, and labor necessary to meet the revised schedule. Should the execution of the work be discontinued for any reason, the Contractor shall notify the RPR at least 24 hours in advance of resuming operations.

The Contractor shall not commence any actual construction prior to the date on which the NTP is issued by the Owner.

The project schedule shall be prepared as a network diagram in Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), or other format, or as otherwise specified. It shall include information on the sequence of work activities, milestone dates, and activity duration. The schedule shall show all work items identified in the project proposal for each work area and shall include the project start date and end date.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a monthly basis, or as otherwise specified in the contract. Submission of the work schedule shall not relieve the Contractor of overall responsibility for scheduling, sequencing, and coordinating all work to comply with the requirements of the contract.

**80-04 Limitation of operations.** The Contractor shall control their operations and the operations of their subcontractors and all suppliers to provide for the free and unobstructed movement of aircraft in the air operations areas (AOA) of the airport.

When the work requires the Contractor to conduct their operations within an AOA of the airport, the work shall be coordinated with airport operations (through the RPR) at least 48 hours prior to commencement of such work. The Contractor shall not close an AOA until so authorized by the RPR and until the necessary temporary marking, signage and associated lighting is in place as provided in Section 70, paragraph 70-08, *Construction Safety and Phasing Plan (CSPP)*.

The Contractor shall be required to conform to safety standards contained in AC 150/5370-2, Operational Safety on Airports During Construction and the approved CSPP.

**80-04.1 Operational safety on airport during construction.** All Contractors' operations shall be conducted in accordance with the approved project Construction Safety and Phasing Plan (CSPP) and the Safety Plan Compliance Document (SPCD) and the provisions set forth within the current version of AC 150/5370-2, Operational Safety on Airports During Construction. The CSPP included within the contract documents conveys minimum requirements for operational safety on the airport during construction activities. The Contractor shall prepare and submit a SPCD that details how it proposes to comply with the requirements presented within the CSPP.

The Contractor shall implement all necessary safety plan measures prior to commencement of any work activity. The Contractor shall conduct routine checks to assure compliance with the safety plan measures.

The Contractor is responsible to the Owner for the conduct of all subcontractors it employs on the project. The Contractor shall assure that all subcontractors are made aware of the requirements of the CSPP and SPCD and that they implement and maintain all necessary measures.

No deviation or modifications may be made to the approved CSPP and SPCD unless approved in writing by the Owner. The necessary coordination actions to review Contractor proposed



modifications to an approved CSPP or approved SPCD can require a significant amount of time.

**80-05 Character of workers, methods, and equipment.** The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the work to full completion in the manner and time required by the contract, plans, and specifications.

All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

Any person employed by the Contractor or by any subcontractor who violates any operational regulations or operational safety requirements and, in the opinion of the RPR, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the RPR, be removed immediately by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without approval of the RPR.

Should the Contractor fail to remove such person or persons, or fail to furnish suitable and sufficient personnel for the proper execution of the work, the RPR may suspend the work by written notice until compliance with such orders.

All equipment that is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the work shall not cause injury to previously completed work, adjacent property, or existing airport facilities due to its use.

When the methods and equipment to be used by the Contractor in accomplishing the work are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the work in conformity with the requirements of the contract, plans, and specifications.

When the contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless otherwise authorized by the RPR. If the Contractor desires to use a method or type of equipment other than specified in the contract, the Contractor may request authority from the RPR to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the RPR determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the RPR may direct. No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this paragraph.

**80-06 Temporary suspension of the work.** The Owner shall have the authority to suspend the work wholly, or in part, for such period or periods the Owner may deem necessary, due to unsuitable weather, or other conditions considered unfavorable for the execution of the work, or for such time necessary due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract.

In the event that the Contractor is ordered by the Owner, in writing, to suspend work for some

unforeseen cause not otherwise provided for in the contract and over which the Contractor has no control, the Contractor may be reimbursed for actual money expended on the work during the period of shutdown. No allowance will be made for anticipated profits. The period of shutdown shall be computed from the effective date of the written order to suspend work to the effective date of the written order to resume the work. Claims for such compensation shall be filed with the RPR within the time period stated in the RPR's order to resume work. The Contractor shall submit with their own claim information substantiating the amount shown on the claim. The RPR will forward the Contractor's claim to the Owner for consideration in accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather or for any other delay provided for in the contract, plans, or specifications.

If it becomes necessary to suspend work for an indefinite period, the Contractor shall store all materials in such manner that they will not become an obstruction nor become damaged in any way. The Contractor shall take every precaution to prevent damage or deterioration of the work performed and provide for normal drainage of the work. The Contractor shall erect temporary structures where necessary to provide for traffic on, to, or from the airport.

**80-07 Determination and extension of contract time.** The number of calendar days shall be stated in the proposal and contract and shall be known as the Contract Time. If the contract time requires extension for reasons beyond the Contractor's control, it shall be adjusted as follows:

**80-07.1 Contract time based on calendar days.** Contract Time based on calendar days shall consist of the number of calendar days stated in the contract counting from the effective date of the Notice to Proceed and including all Saturdays, Sundays, holidays, and non-work days. All calendar days elapsing between the effective dates of the Owner's orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded.

At the time of final payment, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in the contract time shall not consider either cost of work or the extension of contract time that has been covered by a change order or supplemental agreement. Charges against the contract time will cease as of the date of final acceptance.

**80-08 Failure to complete on time.** For each calendar day or working day, as specified in the contract, that any work remains uncompleted after the contract time (including all extensions and adjustments as provided in paragraph 80-07, *Determination and Extension of Contract Time*) the sum specified in the contract and proposal as liquidated damages (LD) will be deducted from any money due or to become due the Contractor or their own surety. Such deducted sums shall not be deducted as a penalty but shall be considered as liquidation of a reasonable portion of damages including but not limited to additional engineering services that will be incurred by the Owner should the Contractor fail to complete the work in the time provided in their contract. See the Form of Proposal located in the beginning of the Project Manual for Liquidated Damages.

Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a waiver on the part of the Owner of any of its rights under the contract.

**80-09 Default and termination of contract.** The Contractor shall be considered in default of their

contract and such default will be considered as cause for the Owner to terminate the contract for any of the following reasons, if the Contractor:

- a. Fails to begin the work under the contract within the time specified in the Notice to Proceed, or
- b. Fails to perform the work or fails to provide sufficient workers, equipment and/or materials to assure completion of work in accordance with the terms of the contract, or
- c. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or
- d. Discontinues the execution of the work, or
- e. Fails to resume work which has been discontinued within a reasonable time after notice to do so, or
- f. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or
- g. Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or
- h. Makes an assignment for the benefit of creditors, or
- i. For any other cause whatsoever, fails to carry on the work in an acceptable manner.

Should the Owner consider the Contractor in default of the contract for any reason above, the Owner shall immediately give written notice to the Contractor and the Contractor's surety as to the reasons for considering the Contractor in default and the Owner's intentions to terminate the contract.

If the Contractor or surety, within a period of 10 days after such notice, does not proceed in accordance therewith, then the Owner will, upon written notification from the RPR of the facts of such delay, neglect, or default and the Contractor's failure to comply with such notice, have full power and authority without violating the contract, to take the execution of the work out of the hands of the Contractor. The Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the work and are acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the RPR will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Owner the amount of such excess.

**80-10 Termination for national emergencies.** The Owner shall terminate the contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction contract as a direct result of an Executive Order of the President with respect to the execution of war or in the interest of national defense.

When the contract, or any portion thereof, is terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract price or as mutually agreed for items of work partially completed or not started. No claims or loss of anticipated profits shall be considered.

Reimbursement for organization of the work, and other overhead expenses, (when not otherwise included in the contract) and moving equipment and materials to and from the job will be considered, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained or ordered by the Contractor for the work and that are not incorporated in the work shall, at the option of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the RPR.

Termination of the contract or a portion thereof shall neither relieve the Contractor of their responsibilities for the completed work nor shall it relieve their surety of its obligation for and concerning any just claim arising out of the work performed.

**80-11 Work area, storage area and sequence of operations.** The Contractor shall obtain approval from the RPR prior to beginning any work in all areas of the airport. No operating runway, taxiway, or air operations area (AOA) shall be crossed, entered, or obstructed while it is operational. The Contractor shall plan and coordinate work in accordance with the approved CSPP and SPCD.

## END OF SECTION 80

## Section 90 Measurement and Payment

**90-01 Measurement of quantities.** All work completed under the contract will be measured by the RPR, or their authorized representatives, using United States Customary Units of Measurement.

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures (or leave-outs) having an area of 9 square feet (0.8 square meters) or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the RPR.

Unless otherwise specified, all contract items which are measured by the linear foot such as electrical ducts, conduits, pipe culverts, underdrains, and similar items shall be measured parallel to the base or foundation upon which such items are placed.

The term “lump sum” when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure or structural unit (in effect, “lump sum” work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

When requested by the Contractor and approved by the RPR in writing, material specified to be measured by the cubic yard (cubic meter) may be weighed, and such weights will be converted to cubic yards (cubic meters) for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the RPR and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

### Measurement and Payment Terms

Term	Description
<b>Excavation and Embankment Volume</b>	In computing volumes of excavation, the average end area method will be used unless otherwise specified.
<b>Measurement and Proportion by Weight</b>	The term “ton” will mean the short ton consisting of 2,000 pounds (907 kg) avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, independently certified scales by competent, qualified personnel at locations designated by the RPR. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the RPR directs, and each truck shall bear a plainly legible identification mark.

Term	Description
<b>Measurement by Volume</b>	Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable for the materials hauled, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.
<b>Asphalt Material</b>	Asphalt materials will be measured by the gallon (liter) or ton (kg). When measured by volume, such volumes will be measured at 60°F (16°C) or will be corrected to the volume at 60°F (16°C) using ASTM D1250 for asphalts. Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when asphalt material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work. When asphalt materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, will be used for computing quantities.
<b>Cement</b>	Cement will be measured by the ton (kg) or hundredweight (km).
<b>Structure</b>	Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.
<b>Timber</b>	Timber will be measured by the thousand feet board measure (MFBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.
<b>Plates and Sheets</b>	The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inch.
<b>Miscellaneous Items</b>	When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.
<b>Scales</b>	<p>Scales must be tested for accuracy and serviced before use. Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end.</p> <p>Scales shall be accurate within 0.5% of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the RPR before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated</p>

Term	Description
	<p>or marked length of the beam or dial and shall not exceed 0.1% of the nominal rated capacity of the scale, but not less than one pound (454 grams). The use of spring balances will not be permitted.</p> <p>In the event inspection reveals the scales have been “overweighing” (indicating more than correct weight) they will be immediately adjusted. All materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of 0.5%.</p> <p>In the event inspection reveals the scales have been under-weighing (indicating less than correct weight), they shall be immediately adjusted. No additional payment to the Contractor will be allowed for materials previously weighed and recorded.</p> <p>Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the RPR can safely and conveniently view them.</p> <p>Scale installations shall have available ten standard 50-pound (2.3 km) weights for testing the weighing equipment or suitable weights and devices for other approved equipment.</p> <p>All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection, for the weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project.</p>
<b>Rental Equipment</b>	<p>Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered in connection with extra work will be measured as agreed in the change order or supplemental agreement authorizing such work as provided in paragraph 90-05 <i>Payment for Extra Work</i>.</p>
<b>Pay Quantities</b>	<p>When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the RPR. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.</p>

**90-02 Scope of payment.** The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials, for performing all work under the contract in a complete and acceptable manner, and for all risk, loss, damage, or expense of whatever character arising out of the nature of the work or the execution thereof, subject to the provisions of Section 70, paragraph 70-18, *No Waiver of Legal Rights*.

When the “basis of payment” subsection of a technical specification requires that the contract price

(price bid) include compensation for certain work or material essential to the item, this same work or material will not also be measured for payment under any other contract item which may appear elsewhere in the contract, plans, or specifications.

**90-03 Compensation for altered quantities.** When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in Section 40, paragraph 40-02, *Alteration of Work and Quantities*, will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from their own unbalanced allocation of overhead and profit among the contract items, or from any other cause.

**90-04 Payment for omitted items.** As specified in Section 40, paragraph 40-03, *Omitted Items*, the RPR shall have the right to omit from the work (order nonperformance) any contract item, except major contract items, in the best interest of the Owner.

Should the RPR omit or order nonperformance of a contract item or portion of such item from the work, the Contractor shall accept payment in full at the contract prices for any work actually completed and acceptable prior to the RPR's order to omit or non-perform such contract item.

Acceptable materials ordered by the Contractor or delivered on the work prior to the date of the RPR's order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.

In addition to the reimbursement hereinbefore provided, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted contract item prior to the date of the RPR's order. Such additional costs incurred by the Contractor must be directly related to the deleted contract item and shall be supported by certified statements by the Contractor as to the nature the amount of such costs.

**90-05 Payment for extra work.** Extra work, performed in accordance with Section 40, paragraph 40-04, *Extra Work*, will be paid for at the contract prices or agreed prices specified in the change order or supplemental agreement authorizing the extra work.

**90-06 Partial payments.** Partial payments will be made to the Contractor at least once each month as the work progresses. Said payments will be based upon estimates, prepared by the RPR, of the value of the work performed and materials complete and in place, in accordance with the contract, plans, and specifications. Such partial payments may also include the delivered actual cost of those materials stockpiled and stored in accordance with paragraph 90-07, *Payment for Materials on Hand*. No partial payment will be made when the amount due to the Contractor since the last estimate amounts to less than five hundred dollars.

a. From the total of the amount determined to be payable on a partial payment, 5% percent of such total amount will be deducted and retained by the Owner for protection of the Owner's interests. Unless otherwise instructed by the Owner, the amount retained by the Owner will be in effect until the final payment is made except as follows:

(1) Contractor may request release of retainage on work that has been partially accepted by the Owner in accordance with Section 50-03. Contractor must provide a certified invoice to the RPR that supports the value of retainage held by the Owner for partially accepted work.



(2) In lieu of retainage, the Contractor may exercise at its option the establishment of an escrow account per paragraph 90-08.

b. The Contractor is required to pay all subcontractors for satisfactory performance of their contracts no later than 30 days after the Contractor has received a partial payment. Contractor must provide the Owner evidence of prompt and full payment of retainage held by the prime Contractor to the subcontractor within 30 days after the subcontractor's work is satisfactorily completed. A subcontractor's work is satisfactorily completed when all the tasks called for in the subcontract have been accomplished and documented as required by the Owner. When the Owner has made an incremental acceptance of a portion of a prime contract, the work of a subcontractor covered by that acceptance is deemed to be satisfactorily completed.

c. When at least 95% of the work has been completed to the satisfaction of the RPR, the RPR shall, at the Owner's discretion and with the consent of the surety, prepare estimates of both the contract value and the cost of the remaining work to be done. The Owner may retain an amount not less than twice the contract value or estimated cost, whichever is greater, of the work remaining to be done. The remainder, less all previous payments and deductions, will then be certified for payment to the Contractor.

It is understood and agreed that the Contractor shall not be entitled to demand or receive partial payment based on quantities of work in excess of those provided in the proposal or covered by approved change orders or supplemental agreements, except when such excess quantities have been determined by the RPR to be a part of the final quantity for the item of work in question.

No partial payment shall bind the Owner to the acceptance of any materials or work in place as to quality or quantity. All partial payments are subject to correction at the time of final payment as provided in paragraph 90-09, *Acceptance and Final Payment*.

The Contractor shall deliver to the Owner a complete release of all claims for labor and material arising out of this contract before the final payment is made. If any subcontractor or supplier fails to furnish such a release in full, the Contractor may furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any potential lien or other such claim. The bond or collateral shall include all costs, expenses, and attorney fees the Owner may be compelled to pay in discharging any such lien or claim.

**90-07 Payment for materials on hand.** Partial payments may be made to the extent of the delivered cost of materials to be incorporated in the work, provided that such materials meet the requirements of the contract, plans, and specifications and are delivered to acceptable sites on the airport property or at other sites in the vicinity that are acceptable to the Owner. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:

- a. The material has been stored or stockpiled in a manner acceptable to the RPR at or on an approved site.
- b. The Contractor has furnished the RPR with acceptable evidence of the quantity and quality of such stored or stockpiled materials.
- c. The Contractor has furnished the RPR with satisfactory evidence that the material and transportation costs have been paid.

- d. The Contractor has furnished the Owner legal title (free of liens or encumbrances of any kind) to the material stored or stockpiled.
- e. The Contractor has furnished the Owner evidence that the material stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the work.

It is understood and agreed that the transfer of title and the Owner's payment for such stored or stockpiled materials shall in no way relieve the Contractor of their responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

In no case will the amount of partial payments for materials on hand exceed the contract price for such materials or the contract price for the contract item in which the material is intended to be used.

No partial payment will be made for stored or stockpiled living or perishable plant materials.

The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this paragraph.

**90-08 Payment of withheld funds.** At the Contractor's option, if an Owner withholds retainage in accordance with the methods described in paragraph 90-06 *Partial Payments*, the Contractor may request that the Owner deposit the retainage into an escrow account. The Owner's deposit of retainage into an escrow account is subject to the following conditions:

- a. The Contractor shall bear all expenses of establishing and maintaining an escrow account and escrow agreement acceptable to the Owner.
- b. The Contractor shall deposit to and maintain in such escrow only those securities or bank certificates of deposit as are acceptable to the Owner and having a value not less than the retainage that would otherwise be withheld from partial payment.
- c. The Contractor shall enter into an escrow agreement satisfactory to the Owner.
- d. The Contractor shall obtain the written consent of the surety to such agreement.

**90-09 Acceptance and final payment.** When the contract work has been accepted in accordance with the requirements of Section 50, paragraph 50-15, *Final Acceptance*, the RPR will prepare the final estimate of the items of work actually performed. The Contractor shall approve the RPR's final estimate or advise the RPR of the Contractor's objections to the final estimate which are based on disputes in measurements or computations of the final quantities to be paid under the contract as amended by change order or supplemental agreement. The Contractor and the RPR shall resolve all disputes (if any) in the measurement and computation of final quantities to be paid within 30 calendar days of the Contractor's receipt of the RPR's final estimate. If, after such 30-day period, a dispute still exists, the Contractor may approve the RPR's estimate under protest of the quantities in dispute, and such disputed quantities shall be considered by the Owner as a claim in accordance with Section 50, paragraph 50-16, *Claims for Adjustment and Disputes*.

After the Contractor has approved, or approved under protest, the RPR's final estimate, and after the RPR's receipt of the project closeout documentation required in paragraph 90-11, *Contractor Final Project Documentation*, final payment will be processed based on the entire sum, or the undisputed sum in case of approval under protest, determined to be due the Contractor less all previous

payments and all amounts to be deducted under the provisions of the contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

If the Contractor has filed a claim for additional compensation under the provisions of Section 50, paragraph 50-16, *Claims for Adjustments and Disputes*, or under the provisions of this paragraph, such claims will be considered by the Owner in accordance with local laws or ordinances. Upon final adjudication of such claims, any additional payment determined to be due the Contractor will be paid pursuant to a supplemental final estimate.

**90-10 Construction warranty.**

- a. In addition to any other warranties in this contract, the Contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, workmanship, or design furnished, or performed by the Contractor or any subcontractor or supplier at any tier.
- b. This warranty shall continue for a period of one year from the date of final acceptance of the work, except as noted. If the Owner takes possession of any part of the work before final acceptance, this warranty shall continue for a period of one year from the date the Owner takes possession. However, this will not relieve the Contractor from corrective items required by the final acceptance of the project work. Light Emitting Diode emitting diode (LED) light fixtures with the exception of obstruction lighting, must be warranted by the manufacturer for a minimum of four (4) years after date of installation inclusive of all electronics.
- c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Owner real or personal property, when that damage is the result of the Contractor's failure to conform to contract requirements; or any defect of equipment, material, workmanship, or design furnished by the Contractor.
- d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for one year from the date of repair or replacement.
- e. The Owner will notify the Contractor, in writing, within seven (7) days after the discovery of any failure, defect, or damage.
- f. If the Contractor fails to remedy any failure, defect, or damage within 14 days after receipt of notice, the Owner shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.
- g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall:  
(1) Obtain all warranties that would be given in normal commercial practice; (2) Require all warranties to be executed, in writing, for the benefit of the Owner, as directed by the Owner, and  
(3) Enforce all warranties for the benefit of the Owner.
- h. This warranty shall not limit the Owner's rights with respect to latent defects, gross mistakes, or fraud.

**90-11 Contractor Final Project Documentation.** Approval of final payment to the Contractor is contingent upon completion and submittal of the items listed below. The final payment will not be approved until the RPR approves the Contractor's final submittal. The Contractor shall:

- a. Provide two (2) copies of all manufacturers warranties specified for materials, equipment, and installations.
- b. Provide weekly payroll records (not previously received) from the general Contractor and all subcontractors.
- c. Complete final cleanup in accordance with Section 40, paragraph 40-08, *Final Cleanup*.
- d. Complete all punch list items identified during the Final Inspection.
- e. Provide complete release of all claims for labor and material arising out of the Contract.
- f. Provide a certified statement signed by the subcontractors, indicating actual amounts paid to the Disadvantaged Business Enterprise (DBE) subcontractors and/or suppliers associated with the project.
- g. When applicable per state requirements, return copies of sales tax completion forms.
- h. Manufacturer's certifications for all items incorporated in the work.
- i. All required record drawings, as-built drawings or as-constructed drawings.
- j. Project Operation and Maintenance (O&M) Manual(s).
- k. Security for Construction Warranty.
- l. Equipment commissioning documentation submitted, if required.

**END OF SECTION 90**

## **Item C-102 Temporary Air and Water Pollution, Soil Erosion, and Siltation Control**

### **DESCRIPTION**

**102-1.** This item shall consist of temporary control measures as shown on the plans or as ordered by the Resident Project Representative (RPR) during the life of a contract to control pollution of air and water, soil erosion, and siltation through the use of silt fences, berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

Temporary erosion control shall be in accordance with the approved erosion control plan; the approved Construction Safety and Phasing Plan (CSPP) and AC 150/5370-2, *Operational Safety on Airports During Construction*. The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

Temporary control measures shall be designed, installed and maintained to minimize the creation of wildlife attractants that have the potential to attract hazardous wildlife on or near public-use airports.

### **MATERIALS**

**102-2.1 Grass.** Grass that will not compete with the grasses sown later for permanent cover per Item T-901 shall be a quick-growing species (such as ryegrass, Italian ryegrass, or cereal grasses) suitable to the area providing a temporary cover. Selected grass species shall not create a wildlife attractant.

**102-2.2 Mulches.** Mulches may be hay, straw, fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials per Item T-908. Mulches shall not create a wildlife attractant.

**102-2.3 Fertilizer.** Fertilizer shall be a standard commercial grade and shall conform to all federal and state regulations and to the standards of the Association of Official Agricultural Chemists.

**102-2.4 Slope drains.** Slope drains may be constructed of pipe, fiber mats, rubble, concrete, asphalt, or other materials that will adequately control erosion.

**102-2.5 Silt fence.** Silt fence shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life. Silt fence shall meet the requirements of ASTM D6461.

**102-2.6 Other.** All other materials shall meet commercial grade standards and shall be approved by

the RPR before being incorporated into the project.

## CONSTRUCTION REQUIREMENTS

**102-3.1 General.** In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

The RPR shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

**102-3.2 Schedule.** Prior to the start of construction, the Contractor shall submit schedules in accordance with the approved Construction Safety and Phasing Plan (CSPP) and the plans for accomplishment of temporary and permanent erosion control work for clearing and grubbing; grading; construction; paving; and structures at watercourses. The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the RPR.

**102-3.3 Construction details.** The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the plans and approved CSPP. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

Where erosion may be a problem, schedule and perform clearing and grubbing operations so that grading operations and permanent erosion control features can follow immediately if project conditions permit. Temporary erosion control measures are required if permanent measures cannot immediately follow grading operations. The RPR shall limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current with the accepted schedule. If seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified as directed by the RPR.

The Contractor shall provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment as directed by the RPR. If temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or directed by the RPR, the work shall be performed by the Contractor and the cost shall be incidental to this item.

The RPR may increase or decrease the area of erodible earth material that can be exposed at any time based on an analysis of project conditions.

The erosion control features installed by the Contractor shall be maintained by the Contractor during the construction period.

Provide temporary structures whenever construction equipment must cross watercourses at frequent intervals. Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into any waterways, impoundments or into natural or manmade channels.

**102-3.4 Installation, maintenance and removal of silt fence.** Silt fences shall extend a minimum of 16 inches (41 cm) and a maximum of 34 inches (86 cm) above the ground surface. Posts shall be set no more than 10 feet (3 m) on center. Filter fabric shall be cut from a continuous roll to the length required minimizing joints where possible. When joints are necessary, the fabric shall be spliced at a support post with a minimum 12-inch (300-mm) overlap and securely sealed. A trench shall be excavated approximately 4 inches (100 mm) deep by 4 inches (100 mm) wide on the upslope side of the silt fence. The trench shall be backfilled and the soil compacted over the silt fence fabric. The Contractor shall remove and dispose of silt that accumulates during construction and prior to establishment of permanent erosion control. The fence shall be maintained in good working condition until permanent erosion control is established. Silt fence shall be removed upon approval of the RPR.

## REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circulars (AC)

AC 150/5200-33            *Hazardous Wildlife Attractants on or Near Airports*

AC 150/5370-2            *Operational Safety on Airports During Construction*

ASTM International (ASTM)

ASTM D6461            *Standard Specification for Silt Fence Materials*

United States Department of Agriculture (USDA)

FAA/USDA Wildlife Hazard Management at Airports, A Manual for Airport Personnel

**END OF ITEM C-102**

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### **Item C-105 Mobilization**

**105-1 Description.** This item of work shall consist of, but is not limited to, work and operations necessary for the movement of personnel, equipment, material and supplies to and from the project site for work on the project.

**105-2 Mobilization limit.** Mobilization shall be limited to 5 percent of the total project cost when detailed schedule of values is submitted to the owner for review and approval.

**105-3 Posted notices.** Prior to commencement of construction activities, the Contractor must post the following documents in a prominent and accessible place where they may be easily viewed by all employees of the prime Contractor and by all employees of subcontractors engaged by the prime Contractor: Equal Employment Opportunity (EEO) Poster "Equal Employment Opportunity is the Law" in accordance with the Office of Federal Contract Compliance Programs Executive Order 11246, as amended; Davis Bacon Wage Poster (WH 1321) - DOL "Notice to All Employees" Poster; and Applicable Davis-Bacon Wage Rate Determination. These notices must remain posted until final acceptance of the work by the Owner.

**105-4 Engineer/RPR field office.** Field Office is not required.

### **REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Office of Federal Contract Compliance Programs (OFCCP)

Executive Order 11246, as amended

EEOC-P/E-1 – Equal Employment Opportunity is the Law Poster

United States Department of Labor, Wage and Hour Division (WHD)

WH 1321 – Employee Rights under the Davis-Bacon Act Poster

**END OF ITEM C-105**

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# **SECTION 4 FEDERAL REQUIREMENTS FOR AIRPORT IMPROVEMENT PROGRAM (AIP) CONTRACTS**

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## **Federal Provisions for Airport Improvement Program (AIP) Contracts**

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## AIP CONTRACT PROVISIONS

### A1 GENERAL

The contractor (including all subcontractors) agrees to insert the following Federal contract provisions in each lower tier contract(s) (e.g. subcontract or sub-agreement) and to incorporate the applicable requirements of these contract provisions by reference for work done under any purchase orders, rental agreements and other agreements for supplies or services. The contractor also agrees to be responsible for compliance with these contract provisions by any subcontractor, lower-tier subcontractor or service provider.

For the Equal Employment Opportunity (EEO) clause, the term **applicant** means an applicant for employment (whether or not the phrase, *for employment*, follows the word applicant or applicants).

For all other clauses, the term **applicant** means a bidder, offeror, or proposer for a contract.

### A2 ACCESS TO RECORDS AND REPORTS

The Contractor must maintain an acceptable cost accounting system. The Contractor agrees to provide the Owner, the Federal Aviation Administration and the Comptroller General of the United States or any of their duly authorized representatives access to any books, documents, papers and records of the Contractor which are directly pertinent to the specific contract for the purpose of making audit, examination, excerpts and transcriptions. The Contractor agrees to maintain all books, records and reports required under this contract for a period of not less than three years after final payment is made and all pending matters are closed.

### A3 AFFIRMATIVE ACTION REQUIREMENT (Contracts Exceeding \$10,000)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

#### Timetables

Goals for minority participation for entire project:	9.72%
Goals for female participation in entire project:	6.9%

These goals are applicable to all of the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the Contractor also is subject to the goals for both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a) and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs (OFCCP) within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.
4. As used in this notice and in the contract resulting from this solicitation, the "covered area" is Maryland, Washington County, Hagerstown.

#### **A4 BREACH OF CONTRACT TERMS (Contracts Exceeding \$150,000)**

Any violation or breach of terms of this contract on the part of the Contractor or its subcontractors may result in the suspension or termination of this contract or such other action that may be necessary to enforce the rights of the parties of this agreement.

Owner will provide Contractor written notice that describes the nature of the breach and corrective actions the Contractor must undertake in order to avoid termination of the contract. Owner reserves the right to withhold payments to Contractor until such time the Contractor corrects the breach or the Owner elects to terminate the contract. The Owner's notice will identify a specific date by which the Contractor must correct the breach. Owner may proceed with termination of



the contract if the Contractor fails to correct the breach by the deadline indicated in the Owner's notice.

The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder are in addition to, and not a limitation of, any duties, obligations, rights and remedies otherwise imposed or available by law.

## **A5 BUY AMERICAN PREFERENCE**

The Contractor agrees to comply with 49 USC § 50101, which provides that Federal funds may not be obligated unless all steel and manufactured goods used in AIP funded projects are produced in the United States, unless the Federal Aviation Administration has issued a waiver for the product; the product is listed as an Excepted Article, Material Or Supply in Federal Acquisition Regulation subpart 25.108; or is included in the FAA Nationwide Buy American Waivers Issued list.

A bidder or offeror must complete and submit the Buy American certification (s) included herein with their bid or offer. The Owner will reject as nonresponsive any bid or offer that does not include the completed Certificate of Buy American Compliance.

### **A5.1 Certificate of Buy American Compliance For Total Facility (Buildings Such As Terminals)**

#### **Certificate of Buy American Compliance for Total Facility**

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with its proposal. The bidder or offeror must indicate how it intends to comply with 49 USC § 50101 by selecting one of the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (i.e. not both) by inserting a checkmark (✓) or the letter "X".

- ☐ Bidder or offeror hereby certifies that it will comply with 49 USC § 50101 by:
- a) Only installing steel and manufactured products produced in the United States; or
  - b) Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
  - c) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

- To provide to the Owner evidence that documents the source and origin of the steel and manufactured product.
- To faithfully comply with providing U.S. domestic products.

- To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.
- ☐ The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 USC § 50101(a) but may qualify for either a Type 3 or Type 4 waiver under 49 USC § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:
  - a) To submit to the Owner within 15 calendar days of the bid opening, a formal waiver request and required documentation that supports the type of waiver being requested.
  - b) That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination that may result in rejection of the proposal.
  - c) To faithfully comply with providing U.S. domestic products at or above the approved U.S. domestic content percentage as approved by the FAA.
  - d) To furnish U.S. domestic product for any waiver request that the FAA rejects.
  - e) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

### **Required Documentation**

**Type 3 Waiver** – The cost of components and subcomponents produced in the United States is more than 60 percent of the cost of all components and subcomponents of the “facility”. The required documentation for a Type 3 waiver is:

- a) Listing of all manufactured products that are not comprised of 100 percent U.S. domestic content (excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety).
- b) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly and installation at project location.
- c) Percentage of non-domestic component and subcomponent cost as compared to total “facility” component and subcomponent costs, excluding labor costs associated with final assembly and installation at project location.

**Type 4 Waiver** – Total cost of project using U.S. domestic source product exceeds the total project cost using non-domestic product by 25 percent. The required documentation for a Type 4 of waiver is:

- a) Detailed cost information for total project using U.S. domestic product
- b) Detailed cost information for total project using non-domestic product

**False Statements:** Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

_____ Date	_____ Signature
_____ Company Name	_____ Title

## **A5.2 Certificate of Buy American Compliance – Manufactured Product (Equipment Acquisition)**

### **Certificate of Buy American Compliance for Manufactured Products**

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with their proposal. The bidder or offeror must indicate how they intend to comply with 49 USC § 50101 by selecting one on the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (not both) by inserting a checkmark (✓) or the letter “X”.

- ☐ Bidder or offeror hereby certifies that it will comply with 49 USC § 50101 by:
- Only installing steel and manufactured products produced in the United States;
  - Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
  - Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

- To provide to the Owner evidence that documents the source and origin of the steel and manufactured product.
  - To faithfully comply with providing U.S. domestic product.
  - To furnish U.S. domestic product for any waiver request that the FAA rejects
  - To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.
- ☐ The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 USC § 50101(a) but may qualify for either a Type 3 or Type 4 waiver under 49 USC § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:

1. To the submit to the Owner within 15 calendar days of the bid opening, a formal waiver request and required documentation that supports the type of waiver being requested.
2. That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination may result in rejection of the proposal.
3. To faithfully comply with providing U.S. domestic products at or above the approved U.S. domestic content percentage as approved by the FAA.
4. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

### **Required Documentation**

**Type 3 Waiver** – The cost of the item components and subcomponents produced in the United States is more that 60 percent of the cost of all components and subcomponents of the “item”. The required documentation for a Type 3 waiver is:

- a) Listing of all product components and subcomponents that are not comprised of 100 percent U.S. domestic content (Excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety).
- b) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly at place of manufacture.
- c) Percentage of non-domestic component and subcomponent cost as compared to total “item” component and subcomponent costs, excluding labor costs associated with final assembly at place of manufacture.

**Type 4 Waiver** – Total cost of project using U.S. domestic source product exceeds the total project cost using non-domestic product by 25 percent. The required documentation for a Type 4 of waiver is:

- a) Detailed cost information for total project using U.S. domestic product
- b) Detailed cost information for total project using non-domestic product

**False Statements:** Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

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Date

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Signature

---

Company Name

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Title

## **A6 CIVIL RIGHTS - GENERAL**

The Contractor agrees to comply with pertinent statutes, Executive Orders and such rules as are promulgated to ensure that no person shall, on the grounds of race, creed, color, national origin, sex, age, or disability be excluded from participating in any activity conducted with or benefiting from Federal assistance.

This provision binds the Contractor and subcontractors from the bid solicitation period through the completion of the contract. This provision is in addition to that required by Title VI of the Civil Rights Act of 1964.

## **A7 CIVIL RIGHTS – TITLE VI ASSURANCE**

### **A7.1 Title VI Solicitation Notice**

**The Board of County Commissioners of Washington County**, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 USC §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders or offerors that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

### **A7.2 Compliance with Nondiscrimination Requirements**

During the performance of this contract, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “Contractor”), agrees as follows:

1. **Compliance with Regulations:** The Contractor (hereinafter includes consultants) will comply with the Title VI List of Pertinent Nondiscrimination Acts and Authorities, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.
2. **Nondiscrimination:** The Contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The Contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21.
3. **Solicitations for Subcontracts, including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding or negotiation made by the Contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the Contractor of the contractor’s obligations under this contract and the

Nondiscrimination Acts and Authorities on the grounds of race, color, or national origin.

4. **Information and Reports:** The Contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the sponsor or the Federal Aviation Administration to be pertinent to ascertain compliance with such Nondiscrimination Acts and Authorities and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the Contractor will so certify to the sponsor or the Federal Aviation Administration, as appropriate, and will set forth what efforts it has made to obtain the information.
5. **Sanctions for Noncompliance:** In the event of a Contractor's noncompliance with the non-discrimination provisions of this contract, the sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:
  - a. Withholding payments to the Contractor under the contract until the Contractor complies; and/or
  - b. Cancelling, terminating, or suspending a contract, in whole or in part.
6. **Incorporation of Provisions:** The Contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations, and directives issued pursuant thereto. The Contractor will take action with respect to any subcontract or procurement as the sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the Contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the Contractor may request the sponsor to enter into any litigation to protect the interests of the sponsor. In addition, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

### **7.3 Title VI List of Pertinent Nondiscrimination Acts and Authorities**

During the performance of this contract, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "Contractor") agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

- Title VI of the Civil Rights Act of 1964 (42 USC § 2000d *et seq.*, 78 stat. 252) (prohibits discrimination on the basis of race, color, national origin);
- 49 CFR part 21 (Non-discrimination in Federally-assisted programs of the Department of Transportation—Effectuation of Title VI of the Civil Rights Act of 1964);
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 USC § 4601) (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);

- Section 504 of the Rehabilitation Act of 1973 (29 USC § 794 *et seq.*), as amended (prohibits discrimination on the basis of disability); and 49 CFR part 27;
- The Age Discrimination Act of 1975, as amended (42 USC § 6101 *et seq.*) (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982 (49 USC § 471, Section 47123), as amended (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987 (PL 100-209) (broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, the Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms “programs or activities” to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act of 1990, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 USC §§ 12131 – 12189) as implemented by U.S. Department of Transportation regulations at 49 CFR parts 37 and 38;
- The Federal Aviation Administration’s Nondiscrimination statute (49 USC § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures nondiscrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 USC 1681 *et seq.*).

#### **A8 CLEAN AIR AND WATER POLLUTION CONTROL (Contracts Exceeding \$150,000)**

Contractor agrees to comply with all applicable standards, orders, and regulations issued pursuant to the Clean Air Act (42 USC § 740-7671q) and the Federal Water Pollution Control Act as amended (33 USC § 1251-1387). The Contractor agrees to report any violation to the Owner immediately upon discovery. The Owner assumes responsibility for notifying the Environmental Protection Agency (EPA) and the Federal Aviation Administration.

Contractor must include this requirement in all subcontracts that exceeds \$150,000.

## **A9 CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS (Contracts Exceeding \$100,000)**

### **1. Overtime Requirements.**

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic, including watchmen and guards, in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

### **2. Violation; Liability for Unpaid Wages; Liquidated Damages.**

In the event of any violation of the clause set forth in paragraph (1) of this clause, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this clause, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this clause.

### **3. Withholding for Unpaid Wages and Liquidated Damages.**

The Federal Aviation Administration (FAA) or the Owner shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this clause.

### **4. Subcontractors.**

The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs (1) through (4) and also a clause requiring the subcontractor to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this clause.



## **A10 COPELAND “ANTI-KICKBACK” ACT (Contracts Exceeding \$2,000)**

Contractor must comply with the requirements of the Copeland “Anti-Kickback” Act (18 USC 874 and 40 USC 3145), as supplemented by Department of Labor regulation 29 CFR part 3. Contractor and subcontractors are prohibited from inducing, by any means, any person employed on the project to give up any part of the compensation to which the employee is entitled. The Contractor and each Subcontractor must submit to the Owner, a weekly statement on the wages paid to each employee performing on covered work during the prior week. Owner must report any violations of the Act to the Federal Aviation Administration.

## **A11 DAVIS-BACON REQUIREMENTS (Contracts Exceeding \$2,000)**

### **1. Minimum Wages.**

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalent thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided* that the employer’s payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can easily be seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination;

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the Contractor, the laborers, or mechanics to be employed in the classification, or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii) (B) or (C) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably

anticipated in providing bona fide fringe benefits under a plan or program: *Provided* that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account asset for the meeting of obligations under the plan or program.

## **2. Withholding.**

The Federal Aviation Administration or the sponsor shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of work, all or part of the wages required by the contract, the Federal Aviation Administration may, after written notice to the Contractor, Sponsor, Applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

## **3. Payrolls and Basic Records.**

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 1(b)(2)(B) of the Davis-Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records that show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and that show the costs anticipated or the actual costs incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit the payrolls to the applicant, Sponsor, or Owner, as the case may be, for transmission to the Federal Aviation Administration. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (*e.g.* the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at [www.dol.gov/whd/forms/wh347instr.htm](http://www.dol.gov/whd/forms/wh347instr.htm) or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker and shall provide them upon request to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit them to the applicant, sponsor, or Owner, as the case may be, for transmission to the Federal Aviation Administration, the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, Sponsor, or Owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) The payroll for the payroll period contains the information required to be provided under 29 CFR § 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR § 5.5 (a)(3)(i), and that such information is correct and complete;

(2) Each laborer and mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations 29 CFR Part 3;

(3) Each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance” required by paragraph (3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The Contractor or subcontractor shall make the records required under paragraph (3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the sponsor, the Federal Aviation Administration, or the Department of Labor and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the Contractor, Sponsor, applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

#### **4. Apprentices and Trainees.**

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman’s hourly rate) specified in the Contractor’s or subcontractor’s registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice’s level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship

program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination that provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate that is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal Employment Opportunity. The utilization of apprentices, trainees, and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

## **5. Compliance with Copeland Act Requirements.**

The Contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

## **6. Subcontracts.**

The Contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR Part 5.5(a)(1) through (10) and such other clauses as the Federal Aviation Administration may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR Part 5.5.

## **7. Contract Termination: Debarment.**

A breach of the contract clauses in paragraph 1 through 10 of this section may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

## **8. Compliance with Davis-Bacon and Related Act Requirements.**

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

## **9. Disputes Concerning Labor Standards.**

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

## **10. Certification of Eligibility.**

(i) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 USC 1001.

## **A12 DEBARMENT AND SUSPENSION (Contracts Exceeding \$25,000)**

### **A12.1 Certification of Offerer/Bidder Regarding Debarment**

By submitting a bid/proposal under this solicitation, the bidder or offeror certifies that neither it nor its principals are presently debarred or suspended by any Federal department or agency from participation in this transaction.

### **A12.2 Certification of Lower Tier Contractors Regarding Debarment**

The successful bidder, by administering each lower tier subcontract that exceeds \$25,000 as a “covered transaction”, must verify each lower tier participant of a “covered transaction” under the project is not presently debarred or otherwise disqualified from participation in this federally assisted project. The successful bidder will accomplish this by:

1. Checking the System for Award Management at website: <http://www.sam.gov>.
2. Collecting a certification statement similar to the Certification of Offerer /Bidder Regarding Debarment, above.
3. Inserting a clause or condition in the covered transaction with the lower tier contract.

If the Federal Aviation Administration later determines that a lower tier participant failed to disclose to a higher tier participant that it was excluded or disqualified at the time it entered the covered transaction, the FAA may pursue any available remedies, including suspension and debarment of the non-compliant participant.

## **A13 DISADVANTAGED BUSINESS ENTERPRISE**

### **A13.1 Information submitted as A Matter of Bidder Responsiveness**

The Owner’s award of this contract is conditioned upon Bidder or Offeror satisfying the good faith effort requirements of 49 CFR §26.53.

As a condition of bid responsiveness, the Bidder or Offeror must submit the following information with its proposal on the forms provided herein:

- 1) The names and addresses of Disadvantaged Business Enterprise (DBE) firms that will participate in the contract;
- 2) A description of the work that each DBE firm will perform;
- 3) The dollar amount of the participation of each DBE firm listed under (1)
- 4) Written statement from Bidder or Offeror that attests their commitment to use the DBE firm(s) listed under (1) to meet the Owner’s project goal; and



- 5) If Bidder or Offeror cannot meet the advertised project DBE goal, evidence of good faith efforts undertaken by the Bidder or Offeror as described in appendix A to 49 CFR part 26.

### **A13.2 Information Submitted as A Matter of Bidder Responsibility**

The Owner's award of this contract is conditioned upon Bidder or Offeror satisfying the good faith effort requirements of 49 CFR §26.53.

The successful Bidder or Offeror must provide written confirmation of participation from each of the DBE firms the Bidder or Offeror lists in its commitment within five days after bid opening.

- 1) The names and addresses of Disadvantaged Business Enterprise (DBE) firms that will participate in the contract;
- 2) A description of the work that each DBE firm will perform;
- 3) The dollar amount of the participation of each DBE firm listed under (1)
- 4) Written statement from Bidder or Offeror that attests their commitment to use the DBE firm(s) listed under (1) to meet the Owner's project goal; and
- 5) If Bidder or Offeror cannot meet the advertised project DBE goal, evidence of good faith efforts undertaken by the Bidder or Offeror as described in appendix A to 49 CFR part 26.

### **A13.3 Race/Gender Neutral Means**

The requirements of 49 CFR part 26 apply to this contract. It is the policy of The Board of County Commissioners of Washington County to practice nondiscrimination based on race, color, sex, or national origin in the award or performance of this contract. The Owner encourages participation by all firms qualifying under this solicitation regardless of business size or ownership.

### **A13.4 Projects Covered by A DBE Program**

#### **DISADVANTAGED BUSINESS ENTERPRISES**

##### **Contract Assurance (§ 26.13) –**

The Contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of Department of Transportation-assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the Owner deems appropriate, which may include, but is not limited to:

- 1) Withholding monthly progress payments;
- 2) Assessing sanctions;
- 3) Liquidated damages; and/or
- 4) Disqualifying the Contractor from future bidding as non-responsible.

**Prompt Payment (§26.29)** – The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than 30 days from the receipt of each payment the prime contractor receives from The Board of County Commissioners of Washington County. The prime contractor agrees further to return retainage payments to each subcontractor within 30 days after the subcontractor’s work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of The Board of County Commissioners of Washington County. This clause applies to both DBE and non-DBE subcontractors.

#### **A14 DISTRACTED DRIVING (Contracts Exceeding \$3,500)**

##### **A14.1 Texting When Driving**

In accordance with Executive Order 13513, “Federal Leadership on Reducing Text Messaging While Driving”, (10/1/2009) and DOT Order 3902.10, “Text Messaging While Driving”, (12/30/2009), the Federal Aviation Administration encourages recipients of Federal grant funds to adopt and enforce safety policies that decrease crashes by distracted drivers, including policies to ban text messaging while driving when performing work related to a grant or subgrant.

In support of this initiative, the Owner encourages the Contractor to promote policies and initiatives for its employees and other work personnel that decrease crashes by distracted drivers, including policies that ban text messaging while driving motor vehicles while performing work activities associated with the project. The Contractor must include the substance of this clause in all sub-tier contracts exceeding \$3,500 that involve driving a motor vehicle in performance of work activities associated with the project.

#### **A15 ENERGY CONSERVATION REQUIREMENTS**

Contractor and Subcontractor agree to comply with mandatory standards and policies relating to energy efficiency as contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 USC 6201*et seq*).

#### **A16 EQUAL EMPLOYMENT OPPORTUNITY (EEO) (Contracts Exceeding \$10,000)**

##### **A16.1 Equal Opportunity Clause**

During the performance of this contract, the Contractor agrees as follows:

(1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action

to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, sexual orientation, gender identify, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff, or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

(3) The Contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the Contractor's commitments under this section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: *Provided, however*, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such

direction by the administering agency the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

### **A16.2 Standard Federal Equal Employment Opportunity Construction Contract Specifications**

1. As used in these specifications:

- a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
- b. "Director" means Director, Office of Federal Contract Compliance Programs (OFCCP), U.S. Department of Labor, or any person to whom the Director delegates authority;
- c. "Employer identification number" means the Federal social security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941;
- d. "Minority" includes:
  - (1) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
  - (2) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin regardless of race);
  - (3) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
  - (4) American Indian or Alaskan native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR part 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors shall be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved plan is individually required to comply with its obligations under the EEO clause and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved Plan

does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through 7p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction contractors performing construction work in a geographical area where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement nor the failure by a union with whom the Contractor has a collective bargaining agreement to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees shall be employed by the Contractor during the training period and the Contractor shall have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees shall be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and shall implement affirmative action steps at least as extensive as the following:

- a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
- b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community

organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source, or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or female sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decisions, including specific review of these items, with onsite supervisory personnel such as superintendents, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other contractors and subcontractors with whom the Contractor does or anticipates doing business.

- i. Direct its recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students; and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations, such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
  - j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer, and vacation employment to minority and female youth both on the site and in other areas of a contractor's workforce.
  - k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR part 60-3.
  - l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel, for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
  - m. Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.
  - n. Ensure that all facilities and company activities are non-segregated except that separate or single user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
  - o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
  - p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the Contractor's EEO policies and affirmative action obligations.
8. Contractors are encouraged to participate in voluntary associations, which assist in fulfilling one or more of their affirmative action obligations (7a through 7p). The efforts of a contractor association, joint contractor union, contractor community, or other similar groups of which the Contractor is a member and participant may be asserted as fulfilling any one or more of its obligations under 7a through 7p of these specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to

documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, if the particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally), the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized.

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination, and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR part 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government, and to keep records. Records shall at least include for each employee, the name, address, telephone number, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.



15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g. those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program)

#### **A17 FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)**

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 CFR part 201, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part-time workers.

The Contractor has full responsibility to monitor compliance to the referenced statute or regulation. The Contractor must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division.

#### **A18 LOBBYING AND INFLUENCING FEDERAL EMPLOYEES (Contracts Exceeding \$100,000)**

##### **A18.1 Certification Regarding Lobbying**

The Bidder or Offeror certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Bidder or Offeror, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, subgrants, and

contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

## **A19 PROHIBITION of SEGREGATED FACILITIES**

(a) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Employment Opportunity clause in this contract.

(b) "Segregated facilities," as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Employment Opportunity clause of this contract.

## **A20 OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970**

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 CFR Part 1910 with the same force and effect as if given in full text. The employer must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The employer retains full responsibility to monitor its compliance and their subcontractor's compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (29 CFR Part 1910). The employer must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

## **A21 PROCUREMENT OF RECOVERED MATERIALS (Contracts Exceeding \$10,000)**

Contractor and subcontractor agree to comply with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, and the regulatory provisions of 40 CFR Part 247. In the performance of this contract and to the extent practicable, the Contractor and subcontractors are to use products containing the highest percentage of recovered materials for items designated by the Environmental Protection Agency (EPA) under 40 CFR Part 247 whenever:

- 1) The contract requires procurement of \$10,000 or more of a designated item during the fiscal year; or
- 2) The contractor has procured \$10,000 or more of a designated item using Federal funding during the previous fiscal year.

The list of EPA-designated items is available at [www.epa.gov/smm/comprehensive-procurement-guidelines-construction-products](http://www.epa.gov/smm/comprehensive-procurement-guidelines-construction-products).

Section 6002(c) establishes exceptions to the preference for recovery of EPA-designated products if the contractor can demonstrate the item is:

- a) Not reasonably available within a timeframe providing for compliance with the contract performance schedule;
- b) Fails to meet reasonable contract performance requirements; or
- c) Is only available at an unreasonable price.

## **A22 SEISMIC SAFETY**

The Contractor agrees to ensure that all work performed under this contract, including work performed by subcontractors, conforms to a building code standard that provides a level of seismic safety substantially equivalent to standards established by the National Earthquake Hazards Reduction Program (NEHRP). Local building codes that model their code after the current version of the International Building Code (IBC) meet the NEHRP equivalency level for seismic safety.

## **A23 TAX DELINQUENCY AND FELONY CONVICTIONS**

### **A23.1 Certification of Offerer/Bidder Regarding Tax Delinquency And Felony Convictions**

The applicant must complete the following two certification statements. The applicant must indicate its current status as it relates to tax delinquency and felony conviction by inserting a checkmark (✓) in the space following the applicable response. The applicant agrees that, if

awarded a contract resulting from this solicitation, it will incorporate this provision for certification in all lower tier subcontracts.

### **Certifications**

- 1) The applicant represents that it is ( ☐ ) is not ( ☐ ) a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.
- 2) The applicant represents that it is ( ☐ ) is not ( ☐ ) is not a corporation that was convicted of a criminal violation under any Federal law within the preceding 24 months.

### **Note**

If an applicant responds in the affirmative to either of the above representations, the applicant is ineligible to receive an award unless the sponsor has received notification from the agency suspension and debarment official (SDO) that the SDO has considered suspension or debarment and determined that further action is not required to protect the Government's interests. The applicant therefore must provide information to the owner about its tax liability or conviction to the Owner, who will then notify the FAA Airports District Office, which will then notify the agency's SDO to facilitate completion of the required considerations before award decisions are made.

### **Term Definitions**

**Felony conviction:** Felony conviction means a conviction within the preceding twenty-four

(24) months of a felony criminal violation under any Federal law and includes conviction of an offense defined in a section of the U.S. code that specifically classifies the offense as a felony and conviction of an offense that is classified as a felony under 18 U.S.C. § 3559.

**Tax Delinquency:** A tax delinquency is any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

## **A24 TERMINATION OF CONTRACT (Contracts Exceeding \$10,000)**

### **A24.1 Termination for Convenience**

The Owner may terminate this contract in whole or in part at any time by providing written notice to the Contractor. Such action may be without cause and without prejudice to any other right or remedy of Owner. Upon receipt of a written notice of termination, except as explicitly directed by

the Owner, the Contractor shall immediately proceed with the following obligations regardless of any delay in determining or adjusting amounts due under this clause:

1. Contractor must immediately discontinue work as specified in the written notice.
2. Terminate all subcontracts to the extent they relate to the work terminated under the notice.
3. Discontinue orders for materials and services except as directed by the written notice.
4. Deliver to the Owner all fabricated and partially fabricated parts, completed and partially completed work, supplies, equipment and materials acquired prior to termination of the work, and as directed in the written notice.
5. Complete performance of the work not terminated by the notice.
6. Take action as directed by the Owner to protect and preserve property and work related to this contract that Owner will take possession.

Owner agrees to pay Contractor for:

- 1) completed and acceptable work executed in accordance with the contract documents prior to the effective date of termination;
- 2) documented expenses sustained prior to the effective date of termination in performing work and furnishing labor, materials, or equipment as required by the contract documents in connection with uncompleted work;
- 3) reasonable and substantiated claims, costs, and damages incurred in settlement of terminated contracts with Subcontractors and Suppliers; and
- 4) reasonable and substantiated expenses to the Contractor directly attributable to Owner's termination action.

Owner will not pay Contractor for loss of anticipated profits or revenue or other economic loss arising out of or resulting from the Owner's termination action.

The rights and remedies this clause provides are in addition to any other rights and remedies provided by law or under this contract.

#### **A24.2 Terminal for Default (Construction)**

Section 80-09 of FAA Advisory Circular 150/5370-10 establishes conditions, rights, and remedies associated with Owner termination of this contract due to default of the Contractor.

#### **A24.3 Termination for Default (Equipment)**

The Owner may, by written notice of default to the Contractor, terminate all or part of this Contract if the Contractor:

1. Fails to commence the Work under the Contract within the time specified in the Notice-to-Proceed;

2. Fails to make adequate progress as to endanger performance of this Contract in accordance with its terms;
3. Fails to make delivery of the equipment within the time specified in the Contract, including any Owner approved extensions;
4. Fails to comply with material provisions of the Contract;
5. Submits certifications made under the Contract and as part of their proposal that include false or fraudulent statements; or
6. Becomes insolvent or declares bankruptcy.

If one or more of the stated events occur, the Owner will give notice in writing to the Contractor and Surety of its intent to terminate the contract for cause. At the Owner's discretion, the notice may allow the Contractor and Surety an opportunity to cure the breach or default.

If within [10] days of the receipt of notice, the Contractor or Surety fails to remedy the breach or default to the satisfaction of the Owner, the Owner has authority to acquire equipment by other procurement action. The Contractor will be liable to the Owner for any excess costs the Owner incurs for acquiring such similar equipment.

Payment for completed equipment delivered to and accepted by the Owner shall be at the Contract price. The Owner may withhold from amounts otherwise due the Contractor for such completed equipment, such sum as the Owner determines to be necessary to protect the Owner against loss because of Contractor default.

Owner will not terminate the Contractor's right to proceed with the Work under this clause if the delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such acceptable causes include: acts of God, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, and severe weather events that substantially exceed normal conditions for the location.

If, after termination of the Contractor's right to proceed, the Owner determines that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the Owner issued the termination for the convenience the Owner.

The rights and remedies of the Owner in this clause are in addition to any other rights and remedies provided by law or under this contract.

## **A25 TRADE RESTRICTION CERTIFICATION**

By submission of an offer, the Offeror certifies that with respect to this solicitation and any resultant contract, the Offeror –

- 1) is not owned or controlled by one or more citizens of a foreign country included in the list of countries that discriminate against U.S. firms as published by the Office of the United States Trade Representative (USTR);
- 2) has not knowingly entered into any contract or subcontract for this project with a person that is a citizen or national of a foreign country included on the list of countries that discriminate against U.S. firms as published by the USTR; and
- 3) has not entered into any subcontract for any product to be used on the Federal project that is produced in a foreign country included on the list of countries that discriminate against U.S. firms published by the USTR.

This certification concerns a matter within the jurisdiction of an agency of the United States of America and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18 USC Section 1001.

The Offeror/Contractor must provide immediate written notice to the Owner if the Offeror/Contractor learns that its certification or that of a subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances. The Contractor must require subcontractors provide immediate written notice to the Contractor if at any time it learns that its certification was erroneous by reason of changed circumstances.

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR 30.17, no contract shall be awarded to an Offeror or subcontractor:

- 1) who is owned or controlled by one or more citizens or nationals of a foreign country included on the list of countries that discriminate against U.S. firms published by the USTR or
- 2) whose subcontractors are owned or controlled by one or more citizens or nationals of a foreign country on such USTR list or
- 3) who incorporates in the public works project any product of a foreign country on such USTR list.

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by this provision. The knowledge and information of a contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

The Offeror agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification without modification in all lower tier subcontracts. The Contractor may rely on the certification of a prospective subcontractor that it is not a firm from a foreign country included on the list of countries that discriminate against U.S. firms as published by USTR, unless the Offeror has knowledge that the certification is erroneous.

This certification is a material representation of fact upon which reliance was placed when making an award. If it is later determined that the Contractor or subcontractor knowingly rendered an

erroneous certification, the Federal Aviation Administration (FAA) may direct through the Owner cancellation of the contract or subcontract for default at no cost to the Owner or the FAA.

## **A26 VETERAN'S PREFERENCE**

In the employment of labor (excluding executive, administrative, and supervisory positions), the Contractor and all sub-tier contractors must give preference to covered veterans as defined within Title 49 United States Code Section 47112. Covered veterans include Vietnam-era veterans, Persian Gulf veterans, Afghanistan-Iraq war veterans, disabled veterans, and small business concerns (as defined by 15 USC 632) owned and controlled by disabled veterans. This preference only applies when there are covered veterans readily available and qualified to perform the work to which the employment relates.



## **SECTION 5 TECHNICAL SPECIFICATIONS**

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SECTION 004373 - PROPOSED SCHEDULE OF VALUES FORM

1.1 BID FORM SUPPLEMENT

- A. A completed Proposed Schedule of Values form is required to be attached to the Bid Form.

1.2 PROPOSED SCHEDULE OF VALUES FORM

- A. Proposed Schedule of Values Form: Provide a breakdown of the bid amount, including alternates, in enough detail to facilitate continued evaluation of bid. Coordinate with the Project Manual table of contents. Provide multiple line items for principal material and subcontract amounts in excess of five percent of the Contract Sum.
- B. Arrange schedule of values using AIA Document G703-1992.
  - 1. Copies of AIA standard forms may be obtained from the American Institute of Architects; [https://www.aiacontracts.org/ library](https://www.aiacontracts.org/library); (800) 942-7732.

END OF DOCUMENT 004373

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SECTION 01 10 00  
SUMMARY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings, general provisions of the Contract, including FAA General Provisions, Washington County General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
1. Work covered by the Contract Documents.
  2. Type of the Contract.
  3. Work phases.
  4. Work under other contracts.
  5. Products ordered in advance.
  6. Owner-furnished products.
  7. Use of premises.
  8. Owner's occupancy requirements.
  9. Specification formats and conventions.
  10. Project Team Qualifications
  11. Utility Permits & Connections
  12. Electronic Drawing Files
- B. Related Sections include the following:
1. Section 01 50 00 - Temporary Facilities and Controls for limitations and procedures governing temporary use of Owner's facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification:
1. Project Name: Hagerstown Regional Airport - Terminal Building Expansion – A.I.P. No. 3-24-0019-059-2018 (DESIGN)
  2. Project Location: Terminal Building Expansion, 18434 Showalter Road, Hagerstown, Maryland, 21742
  3. Building Occupancy Classification: Group A-3 Assembly & Group B Business
  4. Number of Stories: One
  5. Existing Floor Area: 18,360 sf
  6. New Floor Area: 5,550 sf
  7. Total Floor Area: 23,910 gsf
  8. Building Construction Type: Type IIB – Noncombustible/ Unprotected
- B. Architect: Bushey Feight Morin  
473 North Potomac Street  
Hagerstown, Maryland 21740
- C. Owner Representative: Airport Design Consultants, Inc.  
6031 University Blvd., Suite #330  
Ellicott City, MD 21043
- D. Project Description: The Work consists of the following
1. This project includes selective demolition to approximately 2,324 sf roof area with a building addition of approximately 5,554 sf. The combined additional floor space with a new roof over the demolished section totals 7,878 sf of new

building roof cover. An additional roof over a 22' x 48' vehicle canopy equates to 1,056 sf.

The building addition provides a larger Hold Room with a capacity of approximately 300 occupants. The additional Hold Room area provides new amenities including new public toilets, bar and service counters, video displays and convenient charging stations.

An expanded TSA area of approximately 1,775 sf is relocated to provide space for passenger security processing within the expanded area.

The entire remaining areas of over 16,000 sf will require complete renovation for new floor, walls, and ceiling finishes with upgrades to electrical, mechanical, plumbing and sprinkler systems.

Project includes a base bid and six (6) Add Alternates as listed below:

- 1) Passenger Boarding Bridge and Interior Ramp
- 2) Main Terminal Flooring Replacement
- 3) Airline/Concession/Rental Car Counters
- 4) Main Terminal Paint and Wall Finishes
- 5) Exterior Canopies
- 6) New Generator

2. Design Criteria

- a. Applicable Building Codes and Regulations
  - 1) 2015 IBC – International Building Code
  - 2) 2015 IMC – International Mechanical Code
  - 3) 2015 IPC – International plumbing Code
  - 4) 2014 NEC – National Electric Code
  - 5) 2015 NFPA 101 Life Safety Code
  - 6) Maryland Accessibility Code ADAAG
- b. Fire Protection:
  - 1) Supervised automatic sprinkler system
  - 2) Addressable fire alarm system

1.4 TYPE OF CONTRACT

- A. Project will be constructed under a general construction contract.

1.5 WORK PHASES

- A. The Work shall be conducted in accordance with the contract plans.
- B. Before commencing work, contractor shall submit a schedule showing the sequence, commencement and completion dates, and move-out and -in dates of Owner's personnel for all phases of the Work. Provide copies for approval to the Architect and RPR prior to mobilization.
- C. Project Phasing Narrative:
  1. The work of this project is designed and illustrated in numerous phases in order to maintain airport operations at all times. It is imperative that the contractor coordinate closely with the Owner's Resident Project Representative (RPR) to maintain daily flight operations and the published flight scheduled for the two airlines; Allegiant Air and Southern Airways Express. The phasing plans and narrative are intended to provide and overall guide for the construction of the project in its entirety.

Check the airport website (<https://www.washco-md.net/hagerstown-regional-airport/>) for up to date flight information. The operations of these airlines cannot be interrupted, and construction activities must be scheduled around the flight

schedules. Flights schedules may change at the discretion of the airlines.

- a. During construction the Contractor shall be required to protect the TSA security equipment from any dust and debris. Protection must be removed, and equipment made operational when required for airport business.
2. Phase 1 - Preliminary Work
  - a. Mobilize and prepare site for construction.
  - b. Complete underground stormwater piping and all other site work conflicting with the construction of the Modular Building
  - c. Construct Modular Building
  - d. Relocate Ticketing counters and supply power and data at new location
  - e. Make necessary revisions to the doors for new passengers' routes
  - f. Relocate TSA screening equipment as indicated
  - g. Construct new temporary partitions
3. Phase 2- Demolition
  - a. When the new passenger routs and modular building are in operation the building demolition can take place.
4. Phase 3 – Construct Addition
  - b. Complete construction of the additions
5. Phase 4 - Renovate Office Area
  - c. Construct new temporary walls to reroute passengers to utilize the new holding area and exist doors.
  - d. Office personnel to be relocated to the vacated modular building.
  - e. Renovate office area
  - f. Prepare new TSA screening area. Complete all power and data rough in work.
6. Phase 5 - Transition
  - g. Demolish temporary walls and construct new walls around TSA screening area.
  - h. Relocate new TSA screening equipment to its permanent location.
  - i. Complete construction of new permanent walls in this area.
  - j. Remove partitions around vacated TSA office
7. Phase 6 – Renovate Ticketing and Bathrooms.
  - k. Bring in new temporary toilets.
  - l. Complete renovations of the ticketing and bathrooms.
  - m. Remove modular building.
  - n. Complete all repairs and new site work at modular building location.
8. Phase 7 - Terminal Renovations
  - o. Complete floors and signage work in the ticketing area.
  - p. Install casework
  - q. Relocate ticketing to permanent location.
  - r. Complete remainder of finish work as indicated.

## 1.6 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

## 1.7 PRODUCTS ORDERED IN ADVANCE

- A. Not used.

## 1.8 OWNER-FURNISHED PRODUCTS

- A. Owner-Furnished Products:
  - 1. Furniture
  - 2. Office Equipment
  - 3. Work Stations/Systems Furniture

## 1.9 USE OF PREMISES

- A. General: Contractor shall have use of premises for construction operations to the extent and limits as indicated on the Drawings and Specifications.
- B. Use of Site: Limit use of premises to Work in areas as indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Owner Occupancy: Allow for Owner occupancy of Project site.
  - 2. Driveways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
    - c. Remove snow and ice from Project site immediately prior to resuming Work on Project Site.
- C. Use of Building: Maintain building in a weather tight condition throughout construction period when it has been 'dried in'. Repair all damage caused by construction operations. Protect building and its occupants during construction period. The Contractor shall secure said property and maintain a secure perimeter. Contractor shall maintain the functionality of all building systems placed into operation unless the contract calls for other specified actions.

## 1.10 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed on site and inside the building during normal business working hours of 5 a.m. to 5 p.m., Monday through Friday, pending local noise ordinance restrictions, or as otherwise indicated;
  - 1. Weekend Hours: as negotiated with Owner's Representative.
  - 2. Early Morning Hours: as negotiated with Owner's Representative.
  - 3. Hours for Utility Shutdowns: as negotiated with Owner's Representative.
  - 4. See the Allegiant Airline schedule at the end of the section for anticipated flight schedule through August 2019. Contractor shall not impact airline operations at anytime and shall coordinate site access and scheduled construction activities with the Owner's Representative.



## 1.11 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Section Identification:
  - 1. The Specifications use Section numbers and titles to help cross- referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
  - 2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

## 1.12 PROJECT TEAM QUALIFICATIONS

- A. Prior to start of construction, the Contractor shall submit resumes of the following personnel to the Owner/Resident Project Representative (RPR) for review and approval:
  - 1. Project Manager (Office)
  - 2. Superintendent
  - 3. The following as required by the Contractor's approved schedule:
    - a. Superintendent – Building Envelope
    - b. Superintendent – Finishes
    - c. Superintendent/Foreman – Civil, MEP, Fire Protection, Telecom and Security Systems
- B. The resumes must demonstrate that the personnel proposed for assignment to this project and experienced in project similar in scope, budget, and complexity. The Owner shall have the right to require the Contractor to dismiss from the project, any project team member with personnel satisfactory to the Owner, at no additional cost. The Contractor shall not replace any project team member without the consent of the Owner, except with personnel satisfactory to the Owner in all respects.

## 1.13 ELECTRONIC DRAWING FILES

- A. AutoCAD (.dwg) and Autodesk Revit (.rvt) files shall be made available by the consulting team for the contractor's use in coordination and preparation of shop drawings.

- B. The Contractor shall submit a written request for the electronic drawing files desired and complete the A/E Team's Agreement of Electronic File Release Form.
- C. Electronic Drawing files will be transmitted via CD/DVD or the FTP site.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

END OF SECTION 011000

# July 2019

July 2019							August 2019						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7	4	5	6	7	8	9	10
8	9	10	11	12	13	14	11	12	13	14	15	16	17
15	16	17	18	19	20	21	18	19	20	21	22	23	24
22	23	24	25	26	27	28	25	26	27	28	29	30	31
29	30	31											

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
<b>Jun 30</b> <div>11:43am ARR: MYR - HGR</div> <div>12:28pm DPT: HGR -</div> <div>8:34pm ARR: PIE - HGR</div> <div>9:19pm DPT: HGR - PIE</div>	<b>Jul 1</b> <div>8:11am ARR: SFB - HGR</div> <div>8:56am DPT: HGR - SFB</div>	<b>2</b> <div>8:11am ARR: SFB - HGR</div> <div>9:04am DPT: HGR - SFB</div>	<b>3</b> <div>8:19am ARR: SFB - HGR</div> <div>9:04am DPT: HGR - SFB</div>	<b>4</b> <div>11:43am ARR: MYR - HGR</div> <div>12:28pm DPT: HGR -</div> <div>8:34pm ARR: PIE - HGR</div> <div>9:19pm DPT: HGR - PIE</div>	<b>5</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>	<b>6</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>
<b>7</b> <div>11:43am ARR: MYR - HGR</div> <div>12:28pm DPT: HGR -</div> <div>8:34pm ARR: PIE - HGR</div> <div>9:19pm DPT: HGR - PIE</div>	<b>8</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>	<b>9</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>	<b>10</b> <div>8:19am ARR: SFB - HGR</div> <div>9:04am DPT: HGR - SFB</div>	<b>11</b> <div>11:43am ARR: MYR - HGR</div> <div>12:28pm DPT: HGR -</div> <div>8:34pm ARR: PIE - HGR</div> <div>9:19pm DPT: HGR - PIE</div>	<b>12</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>	<b>13</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>
<b>14</b> <div>11:43am ARR: MYR - HGR</div> <div>12:28pm DPT: HGR -</div> <div>8:34pm ARR: PIE - HGR</div> <div>9:19pm DPT: HGR - PIE</div>	<b>15</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>	<b>16</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>	<b>17</b> <div>8:19am ARR: SFB - HGR</div> <div>9:04am DPT: HGR - SFB</div>	<b>18</b> <div>11:43am ARR: MYR - HGR</div> <div>12:28pm DPT: HGR -</div> <div>8:34pm ARR: PIE - HGR</div> <div>9:19pm DPT: HGR - PIE</div>	<b>19</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>	<b>20</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>
<b>21</b> <div>11:43am ARR: MYR - HGR</div> <div>12:28pm DPT: HGR -</div> <div>8:34pm ARR: PIE - HGR</div> <div>9:19pm DPT: HGR - PIE</div>	<b>22</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>	<b>23</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>	<b>24</b> <div>8:40pm ARR: SFB - HGR</div> <div>9:25pm DPT: HGR - SFB</div>	<b>25</b> <div>11:43am ARR: MYR - HGR</div> <div>12:28pm DPT: HGR -</div> <div>8:34pm ARR: PIE - HGR</div> <div>9:19pm DPT: HGR - PIE</div>	<b>26</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>	<b>27</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>
<b>28</b> <div>11:43am ARR: MYR - HGR</div> <div>12:28pm DPT: HGR -</div> <div>8:27pm ARR: PIE - HGR</div> <div>9:12pm DPT: HGR - PIE</div>	<b>29</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>	<b>30</b> <div>8:09am ARR: SFB - HGR</div> <div>8:54am DPT: HGR - SFB</div>	<b>31</b> <div>8:26am ARR: SFB - HGR</div> <div>9:11am DPT: HGR - SFB</div>	<b>Aug 1</b> 	<b>2</b> 	<b>3</b> 

# August 2019

September 2019

August 2019

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Jul 28	29	30	31	Aug 1 11:42am ARR: MYR - HGR 12:27pm DPT: HGR - SFB 8:26pm ARR: PIE - HGR 9:11pm DPT: HGR - PIE	2 3:12pm ARR: SFB - HGR 3:57pm DPT: HGR - SFB	3
4 11:42am ARR: MYR - HGR 12:27pm DPT: HGR - SFB 8:26pm ARR: PIE - HGR 9:11pm DPT: HGR - PIE	5 3:12pm ARR: SFB - HGR 3:57pm DPT: HGR - SFB	6	7 5:57pm ARR: SFB - HGR 6:42pm DPT: HGR - SFB	8 2:29pm ARR: PIE - HGR 3:14pm DPT: HGR - PIE 8:32pm ARR: MYR - HGR 9:17pm DPT: HGR - MYR	9 3:14pm ARR: SFB - HGR 3:59pm DPT: HGR - SFB	10
11 2:29pm ARR: PIE - HGR 3:14pm DPT: HGR - SFB 6:53pm ARR: MYR - HGR 7:38pm DPT: HGR - MYR	12 3:14pm ARR: SFB - HGR 3:59pm DPT: HGR - SFB	13	14 6:11pm ARR: SFB = HGR 6:56pm DPT: HGR - SFB	15	16 2:53pm ARR: SFB - HGR 3:38pm DPT: HGR - SFB	17
18	19 2:53pm ARR: SFB - HGR 3:38pm DPT: HGR - SFB	20	21	22	23 2:53pm ARR: SFB - HGR 3:38pm DPT: HGR - SFB	24
25	26 2:53pm ARR: SFB - HGR 3:38pm DPT: HGR - SFB	27	28	29	30 2:53pm ARR: SFB - HGR 3:38pm DPT: HGR - SFB	31



# September 2019

September 2019

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

October 2019

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Sep 1	2 2:53pm ARR: SFB - HGR 3:38pm DPT: HGR - SFB	3	4	5	6 3:07pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	7
8	9 3:07pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	10	11	12	13 3:07pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	14
15	16 3:07pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	17	18	19	20 3:07pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	21
22	23 3:07pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	24	25	26	27 3:07pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	28
29	30 3:07pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	Oct 1	2	3	4	5

# October 2019

October 2019

Su	Mo	Tu	We	Th	Fr	Sa
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

November 2019

Su	Mo	Tu	We	Th	Fr	Sa
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Sep 29	30	Oct 1	2	3	4	5
6	7 2:55pm ARR: HGR - SFB 3:40pm DPT: HGR - SFB	8	9 11:48am ARR: SFB - HGR 12:33pm DPT: HGR - SFB	10	11 2:55pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	12
13	14 2:55pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	15	16 6:05pm ARR: SFB - HGR 6:50pm DPT: HGR - SFB	17	18 2:55pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	19
20	21 2:55pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	22	23	24	25 2:55pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	26
27	28 2:55pm ARR: SFB - HGR 3:40pm DPT: HGR - SFB	29	30	31	Nov 1	2

# November 2019

November 2019							December 2019						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
3	4	5	6	7	8	9	1	2	3	4	5	6	7
10	11	12	13	14	15	16	8	9	10	11	12	13	14
17	18	19	20	21	22	23	15	16	17	18	19	20	21
24	25	26	27	28	29	30	22	23	24	25	26	27	28
							29	30	31				

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Oct 27	28	29	30	31	Nov 1	2
					2:57pm ARR: SFB - HGR 3:42pm DPT: HGR - SFB	
3	4	5	6	7	8	9
	2:57pm ARR: SFB - HGR 3:42pm DPT: HGR - SFB				2:57pm ARR: SFB - HGR 3:42pm DPT: HGR - SFB	
10	11	12	13	14	15	16
	2:57pm ARR: SFB - HGR 3:42pm DPT: HGR - SFB				8:59am ARR: SFB - HGR 9:44am DPT: HGR - SFB	5:12pm ARR: SFB - HGR 5:57pm DPT: HGR - SFB
17	18	19	20	21	22	23
	8:59am ARR: SFB - HGR 9:44am DPT: HGR - SFB				8:59am ARR: SFB - HGR 9:44am DPT: HGR - SFB	8:59am ARR: SFB - HGR 9:44am DPT: HGR - SFB
24	25	26	27	28	29	30
	8:59am ARR: SFB - HGR 9:44am DPT: HGR - SFB	3:25pm ARR: SFB - HGR 4:10pm DPT: HGR - SFB	1:42pm ARR: SFB - HGR 2:27pm DPT: HGR - SFB			3:25pm ARR: SFB - HGR 4:10pm DPT: HGR - SFB

# December 2019

December 2019							January 2020						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7	5	6	7	8	9	10	11
8	9	10	11	12	13	14	12	13	14	15	16	17	18
15	16	17	18	19	20	21	19	20	21	22	23	24	25
22	23	24	25	26	27	28	26	27	28	29	30	31	
29	30	31											

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Dec 1 1:42pm ARR: SFB - HGR 2:27pm DPT: HGR - SFB	2 7:40pm ARR: SFB - HGR 8:25pm DPT: HGR - SFB	3	4	5	6 8:52am ARR: SFB - HGR 9:37am DPT: HGR - SFB	7 8:52am ARR: SFB - HGR 9:37am DPT: HGR - SFB
8	9 8:52am ARR: HGR - SFB 9:37am DPT: HGR - SFB	10	11	12	13 8:52am ARR: SFB - HGR 9:37am DPT: HGR - SFB	14
15	16 8:52am ARR: SFB - HGR 9:37am DPT: HGR - SFB	17	18	19 8:21pm ARR: SFB - HGR 9:06pm DPT: HGR - SFB	20 8:26am ARR: SFB - HGR 9:11am DPT: HGR - SFB	21 8:48pm ARR: SFB - HGR 9:33pm DPT: HGR - SFB
22	23 8:26am ARR: SFB - HGR 9:11am DPT: HGR - SFB	24	25	26 8:21pm ARR: SFB - HGR 9:06pm DPT: HGR - SFB	27 8:26am ARR: SFB - HGR 9:11am DPT: HGR - SFB	28 8:48pm ARR: SFB - HGR 9:33pm DPT: HGR - SFB
29	30 8:26am ARR: SFB - HGR 9:11am DPT: HGR - SFB	31	Jan 1, 20	2	3	4



# January 2020

January 2020							February 2020						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
5	6	7	8	9	10	11	2	3	4	5	6	7	8
12	13	14	15	16	17	18	9	10	11	12	13	14	15
19	20	21	22	23	24	25	16	17	18	19	20	21	22
26	27	28	29	30	31		23	24	25	26	27	28	29

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Dec 29	30	31	Jan 1, 20	2 8:29pm ARR: SFB - HGR 9:14pm DPT: HGR - SFB	3 8:25am ARR: SFB - HGR 9:10am DPT: HGR - SFB	4 8:45am ARR: SFB - HGR 9:30am DPT: HGR - SFB
5 8:29pm ARR: SFB - HGR 9:14pm DPT: SFB - HGR	6 8:25am ARR: SFB - HGR 9:10am DPT: HGR - SFB	7	8	9	10 9:48am ARR: SFB - HGR 10:33am DPT: HGR - SFB	11
12	13 9:48am ARR: SFB - HGR 10:33am DPT: HGR - SFB	14	15	16	17 9:48am ARR: SFB - HGR 10:33am DPT: HGR - SFB	18
19	20 9:48am ARR: SFB - HGR 10:33am DPT: HGR - SFB	21	22	23	24 9:48am ARR: SFB - HGR 10:33am DPT: HGR - SFB	25
26	27 9:48am ARR: SFB - HGR 10:33am DPT: HGR - SFB	28	29	30	31 9:50am ARR: SFB - HGR 10:35am DPT: HGR - SFB	Feb 1

# February 2020

February 2020							March 2020						
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
2	3	4	5	6	7	8	1	2	3	4	5	6	7
9	10	11	12	13	14	15	8	9	10	11	12	13	14
16	17	18	19	20	21	22	15	16	17	18	19	20	21
23	24	25	26	27	28	29	22	23	24	25	26	27	28
							29	30	31				

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Jan 26	27	28	29	30	31	Feb 1
2	3 9:50am ARR: SFB - HGR 10:35am DPT: HGR - SFB	4	5	6	7 9:50am ARR: SFB - HGR 10:35am DPT: HGR - SFB	8
9	10 9:50am ARR: SFB - HGR 10:35am DPT: HGR - SFB	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

## SECTION 012100 - ALLOWANCES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
  - 1. Lump-sum allowances.

#### 1.2 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise RPR and Architect of the date when final selections must be completed by the Owner, or purchase and delivery of each product or system described by an allowance must be completed by the Contractor to avoid delaying the Work.
- B. At RPR and Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by RPR and Architect from the designated supplier.

#### 1.3 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- B. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

#### 1.5 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include delivery to Project site.

## 1.6 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between the approved allowance amount and the cost associated with the change in scope of the allowance.
  - 1. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
  - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
  - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

### 3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

### 3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Lump-Sum Allowance: Include the sum of \$60,000. Include the stipulated sum listed for use as directed by the County to complete work associated with Internet Technology and Communications.
  - 1. This allowance includes material cost, receiving, handling, warranties, installation and Contractor overhead and profit and any other work necessary to complete the allowance.

END OF SECTION 012100

SECTION 01 23 00  
ALTERNATES

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A Schedule of Alternates is included at the end of this Section.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. ALTERNATE No. 1: Passenger Boarding Bridge and Interior Ramp
  - 1. In accordance with the Drawings and Specifications, submit the cost to provide the Passenger Boarding Bridge and Interior Ramp and all associated work as indicated on the Contract Drawings.
- B. ALTERNATE No. 2: Main Terminal Flooring Replacement
  - 1. In accordance with the Drawings and Specifications, submit the cost to provide replacement of the main terminal flooring and sanitary sewer line and all associated work as indicated on the Contract Drawings.

- C. ALTERNATE No. 3: Airline/Concession/Rental Car Counters
  - 1. In accordance with the Drawings and Specifications, submit the cost to provide Airline, Concession and Rental Car Counters and all associated work as indicated on the Contract Drawings.
- D. ALTERNATE No. 4: Main Terminal Paint and Wall Finishes
  - 1. In accordance with the Drawings and Specifications, submit the cost to provide paint and wall finishes for the Main Terminal and all associated work as indicated on the Contract Drawings.
- E. ALTERNATE No. 5: Exterior Canopies
  - 1. In accordance with the Drawings and Specifications, submit cost for the exterior canopies (airside and landside) and all associated work as indicated on the Contract Drawings.
- F. ALTERNATE No. 6: New Generator
  - 1. In accordance with the Drawings and Specifications, submit the cost to provide a new diesel generator and all associated work as indicated on the Contract Drawings.

END OF SECTION 012300

SECTION 012600  
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
  - 1. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue through RPR supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: RPR will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Work Change Proposal Requests issued by RPR are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and

finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- e. Quotation Form: Use forms acceptable to RPR.

- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to RPR.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Not used.
7. Proposal Request Form: Use form acceptable to RPR.

## 1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Not used.

## 1.6 CHANGE ORDER PROCEDURES

- A. Upon approval of a Work Change Proposal Request by the Owner, FAA and MAA, RPR will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

## 1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: RPR may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.



1.8 WORK CHANGE DIRECTIVE

- A. Work Change Directive: RPR may issue a Work Change Directive on EJCDC Document C-940. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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SECTION 012900  
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Document 004373 "Proposed Schedule of Values Form" for requirements for furnishing proposed schedule of values with bid.
  - 2. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 3. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Coordinate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with Continuation Sheets.
    - b. Submittals Schedule.
    - c. Contract List
    - d. List of products.
    - e. List of principal suppliers and fabricators.
  - 2. Submit the schedule of values to the RPR at earliest possible date. Initial Applications for Payment will not be reviewed until the Schedule of Values has been reviewed and approved by the RPR.

3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
  4. Subschedules for Separate Elements of Work: Not used.
  5. Subschedules for Separate Design Contracts: Not used.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
    - a. Project name and location.
    - b. Owner's name.
    - c. Owner's Project number.
    - d. Name of RPR.
    - e. RPR's Project number.
    - f. Contractor's name and address.
    - g. Date of submittal.
  2. Arrange schedule of values consistent with format of AIA Document G703.
  3. Arrange the Schedule of Values in tabular form, with separate columns to indicate the following for each item listed:
    - a. Related Specification Section or division.
    - b. Description of the Work.
    - c. Name of subcontractor.
    - d. Name of manufacturer or fabricator.
    - e. Name of supplier.
    - f. Change Orders (numbers) that affect value.
    - g. Dollar value.
      - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
  4. Provide a breakdown of the Contract Price in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate. Include separate line items under required principal subcontracts for the following items. The value assigned to the total of these line items shall be 5 percent of the Contract Price:
    - a. Testing and commissioning activities.
    - b. Operation and Maintenance manuals.
    - c. Punch list activities.
    - d. Project Record Documents.
    - e. Bonds and warranties.
    - f. Demonstration and training.
  5. Round amounts to nearest whole dollar. Total shall equal Contract Price.
  6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

- a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.
7. Allowances: Not used.
8. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
9. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
10. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
11. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
12. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
13. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

#### 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by the RPR and paid for by Owner.
  1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Application for Payment shall coincide with monthly schedule update, or as otherwise indicated in the Agreement between the Owner and Contractor. The period covered by each Application for Payment starts on the day following the end of the preceding period and shall not exceed one calendar month, unless otherwise approved by the RPR.
- C. Payment Application Times: Submit Application for Payment to RPR by the 25<sup>th</sup> of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
  1. Submit draft copy of Application for Payment seven days prior to due date for review by RPR.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
  1. Other Application for Payment forms proposed by the Contractor may be acceptable to RPR and Owner. Submit forms for approval with initial submittal of schedule of values.

- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. RPR will return incomplete applications without action.
1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
  2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
  4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
  5. Include retainage of 5% to be held by owner per Section 90 of the FAA General Provisions.
- F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
  2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
  3. Provide summary documentation for stored materials indicating the following:
    - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- G. Transmittal: Submit two signed and notarized original copies of each Application for Payment to RPR by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
  2. Prior to submitting the three signed and notarized Application for Payment, Contractor shall submit one draft copy of the Application for Payment to the RPR for review and comment one week in advance of submitting signed and notarized Application for Payment.
  3. Attach the Certified Payrolls to the transmittal or under separate cover. Pay requests may be reviewed, but not processed until certified payrolls are submitted and approved.

- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  2. When an application shows completion of an item, submit conditional final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of Values.
  3. Contractor's Construction Schedule (preliminary if not final).
  4. Products list (preliminary if not final).
  5. Submittal Schedule (preliminary if not final).
  6. List of Contractor's staff assignments.
  7. List of Contractor's principal consultants.
  8. Copies of building permits.
  9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  10. Initial progress report.
  11. Report of preconstruction conference.
  12. Certificates of insurance and insurance policies.
  13. Performance and payment bonds.
  14. Initial settlement survey and damage report if required.
  15. Submittal and approval of Contractor Safety Plan.
  16. Subcontractor Payment Form.
- J. Monthly Application for Payment: Administrative actions and submittals that shall accompany the submittal of Contractor's monthly Application for Payment include the following:
1. Subcontractor Payment Form.
  2. Monthly Progress Report, prepared according to requirements specified in Division 01 Section "Construction Progress Documentation."
  3. Evidence of payment for material on-site if reimbursement for such material is being requested.
  4. Update of Contract Record Documents.
- K. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Price.
    - a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."
  2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Certification of completion of final punch list items.
  3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  4. Updated final statement, accounting for final changes to the Contract Sum.
  5. AIA Document G706.
  6. AIA Document G706A.
  7. AIA Document G707.
  8. Evidence that claims have been settled.
  9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
  10. Final liquidated damages settlement statement.
  11. Proof that taxes, fees, and similar obligations are paid.
  12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900



SECTION 01 30 00  
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordination and project conditions.
- B. Field engineering.
- C. Preconstruction meeting.
- D. Site mobilization meeting.
- E. Progress meetings.
- F. Pre-installation meetings.

1.2 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate scheduling, submittals, and Work of various sections of the specifications to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial occupancy.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 FIELD ENGINEERING

- A. The General Contractor shall employ a Land Surveyor registered in the State of Maryland and acceptable to Owner/RPR for layout.
- B. Locate and protect survey control and reference points. Promptly notify RPR of discrepancies discovered.
- C. Control datum for survey is that shown on Drawings.
- D. Verify set-backs and easements; confirm drawing dimensions and elevations.
- E. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.
- F. Submit copy of site drawing and certificate signed by Land Surveyor certifying elevations and locations of the Work are in conformance with Contract Documents.

- G. Maintain complete and accurate log of control and survey work as Work progresses.
- H. On completion of foundation walls and major site improvements, prepare certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.
- I. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

#### 1.4 PRECONSTRUCTION MEETING

- A. The Owner/RPR will schedule meeting after Notice of Award.
- B. Attendance Required: Owner, RPR, Architect/Engineer and Contractor.
- C. Agenda:
  - 1. Previously Execution of Owner-Contractor Agreement.
  - 2. Submission of executed bonds and insurance certificates.
  - 3. Distribution of Contract Documents.
  - 4. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
  - 5. Designation of personnel representing parties in Contract, and RPR.
  - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  - 7. Security
  - 8. CSPP
  - 9. Airport Operations
  - 10. DBE Procedures and reporting
  - 11. Submittals/RFIs
  - 12. Scheduling.
  - 13. Notice to Proceed
- D. The RPR will record minutes and distribute copies within seven (7) days after meeting to major participants.

#### 1.5 SITE MOBILIZATION MEETING – Not required.

#### 1.6 PROGRESS MEETINGS

- A. The Owner/RPR will schedule and administer meetings throughout progress of the Work at weekly intervals.
- B. The General Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required: Contractor, major subcontractors and suppliers, Owner, RPR, Architect/Engineer, as appropriate to agenda topics for each meeting.
- D. Agenda:
  - 1. Review minutes of previous meetings.
  - 2. Review of Work progress.
  - 3. Field observations, problems, and decisions.
  - 4. Identification of problems impeding planned progress.
  - 5. Review of submittals schedule and status of submittals.
  - 6. Review of off-site fabrication and delivery schedules.
  - 7. Maintenance of progress schedule.
  - 8. Corrective measures to regain projected schedules.
  - 9. Planned progress during succeeding work period with two week look ahead.

10. Coordination of projected progress.
  11. Maintenance of quality and work standards.
  12. Effect of proposed changes on progress schedule and coordination.
  13. Safety and Security
  14. Other business relating to Work.
- E. The RPR will record minutes and distribute copies within seven (7) days after meeting to participants.

1.7 PREINSTALLATION MEETING

- A. When required in individual specification sections, convene preinstallation meeting at Project site prior to commencing work of specific section.
- B. Require attendance of parties directly affecting, or affected by, Work of specific section.
- C. Notify Owner/RPR seven (7) days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
  1. Review conditions of installation, preparation and installation procedures.
  2. Review coordination with related work.
- E. The Contractor will record minutes and distribute copies within seven (7) days after meeting to participants.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

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## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. RFIs.
  - 4. Digital project management procedures.
  - 5. Web-based Project management software package.
  - 6. Project meetings.
    - a. Pre-construction conference.
    - b. Pre-installation conference.
    - c. Progress meetings.
- B. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

#### 1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, RPR, or Contractor seeking information required by or clarifications of the Contract Documents.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.

3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Prior to starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
  1. Post copies of list in Project meeting room, in temporary field office, and in prominent location in built facility. Keep list current at all times.

#### 1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
  1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
  1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  1. Preparation of Contractor's construction schedule.
  2. Preparation of the schedule of values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.
  8. Startup and adjustment of systems.

#### 1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is

required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
  - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
  - b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
  - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
  - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
  - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
  - f. Indicate required installation sequences.
  - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
  - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
  - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
  - c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:
    - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    - c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
    - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
  8. Fire-Protection System: Show the following:
    - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
  9. Review: RPR will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If RPR determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, RPR will so inform Contractor, who shall make suitable modifications and resubmit.
  10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittals."
- C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
  2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
  3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
  4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
  5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
  6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
  7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.
- D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
  2. File Preparation Format: DWG, Version 2018, operating in Microsoft Windows operating system.
  3. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.



4. Architect/RPR will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
  - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
  - b. Digital Data Software Program: Drawings are available in AutoCAD .dwg and Revit .rvt format, Version 2018 operating in Microsoft Windows operating system.
  - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and RPR.

#### 1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  1. RPR will return without response those RFIs submitted to RPR by other entities controlled by Contractor.
  2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  1. Project name.
  2. Owner name.
  3. Owner's Project number.
  4. Name of RPR.
  5. RPR's Project number.
  6. Date.
  7. Name of Contractor.
  8. RFI number, numbered sequentially.
  9. RFI subject.
  10. Specification Section number and title and related paragraphs, as appropriate.
  11. Drawing number and detail references, as appropriate.
  12. Field dimensions and conditions, as appropriate.
  13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  14. Contractor's signature.
  15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to RPR.
  1. Attachments shall be electronic files in PDF format.

- D. RPR's Action: RPR will review each RFI, determine action required, and respond. Allow seven days for RPR's response for each RFI. RFIs received by RPR after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of RPR's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  2. RPR's action may include a request for additional information, in which case RPR's time for response will date from time of receipt by RPR of additional information.
  3. RPR's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify RPR in writing within 5 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly.  
Software log with not less than the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of RPR.
  4. RFI number, including RFIs that were returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date RPR's response was received.
  8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- F. On receipt of RPR's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify RPR within seven days if Contractor disagrees with response.

## 1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model and CAD drawings will be provided by Architect for Contractor's use during construction.
1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.

2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in AutoCAD .dwg and Revit .rvt, both Version 2018, operation on Microsoft Windows operating system.
4. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
  - a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

- B. Web-Based Project Management Software Package: Owner will provide Procore available for the contractor.

## 1.9 PROJECT MEETINGS

- A. General: RPR will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, RPR, and Architect, within three days of the meeting.
- B. Preconstruction Conference: RPR will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and RPR, but no later than 30 days after Notice to Proceed.
  1. Attendees: Authorized representatives of Owner, RPR, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Responsibilities and personnel assignments.
    - b. Tentative construction schedule.
    - c. Phasing.
    - d. Critical work sequencing and long lead items.
    - e. Designation of key personnel and their duties.
    - f. Lines of communications.
    - g. Use of web-based Project software.
    - h. Procedures for processing field decisions and Change Orders.
    - i. Procedures for RFIs.
    - j. Procedures for testing and inspecting.
    - k. Procedures for processing Applications for Payment.
    - l. Distribution of the Contract Documents.
    - m. Submittal procedures.
    - n. Preparation of Record Documents.
    - o. Use of the premises and existing building.

- p. Work restrictions.
    - q. Working hours.
    - r. Owner's occupancy requirements.
    - s. Responsibility for temporary facilities and controls.
    - t. Procedures for moisture and mold control.
    - u. Procedures for disruptions and shutdowns.
    - v. Construction waste management and recycling.
    - w. Parking availability.
    - x. Office, work, and storage areas.
    - y. Equipment deliveries and priorities.
    - z. First aid.
    - aa. Security.
    - bb. Progress cleaning.
  - 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Sustainable Design Requirements Coordination Conference: Not used.
- D. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, RPR, and Owner's Commissioning Authority of scheduled meeting dates.
  - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility requirements.
    - k. Time schedules.
    - l. Weather limitations.
    - m. Manufacturer's written instructions.
    - n. Warranty requirements.
    - o. Compatibility of materials.
    - p. Acceptability of substrates.
    - q. Temporary facilities and controls.
    - r. Space and access limitations.
    - s. Regulations of authorities having jurisdiction.
    - t. Testing and inspecting requirements.
    - u. Installation procedures.
    - v. Coordination with other work.

- w. Required performance results.
  - x. Protection of adjacent work.
  - y. Protection of construction and personnel.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- E. Project Closeout Conference: RPR will schedule and conduct a project closeout conference, at a time convenient to Owner and RPR, but no later than 90 days prior to the scheduled date of Substantial Completion.
- 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  - 2. Attendees: Authorized representatives of Owner, RPR, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    - a. Preparation of Record Documents.
    - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    - c. Procedures for completing and archiving web-based Project software site data files.
    - d. Submittal of written warranties.
    - e. Requirements for completing sustainable design documentation.
    - f. Requirements for preparing operations and maintenance data.
    - g. Requirements for delivery of material samples, attic stock, and spare parts.
    - h. Requirements for demonstration and training.
    - i. Preparation of Contractor's punch list.
    - j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    - k. Submittal procedures.
    - l. Owner's partial occupancy requirements.
    - m. Installation of Owner's furniture, fixtures, and equipment.
    - n. Responsibility for removing temporary facilities and controls.
  - 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- F. Progress Meetings: RPR will conduct progress meetings at weekly intervals initially and will change to bi-weekly or as needed basis.
- 1. Coordinate dates of meetings with preparation of payment requests.
  - 2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, RPR, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of

- future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
- a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
- 1) Review schedule for next period.
- b. Review present and future needs of each entity present, including the following:
- 1) Interface requirements.
  - 2) Sequence of operations.
  - 3) Resolution of BIM component conflicts.
  - 4) Status of submittals.
  - 5) Status of sustainable design documentation.
  - 6) Deliveries.
  - 7) Off-site fabrication.
  - 8) Access.
  - 9) Site use.
  - 10) Temporary facilities and controls.
  - 11) Progress cleaning.
  - 12) Quality and work standards.
  - 13) Status of correction of deficient items.
  - 14) Field observations.
  - 15) Status of RFIs.
  - 16) Status of Proposal Requests.
  - 17) Pending changes.
  - 18) Status of Change Orders.
  - 19) Pending claims and disputes.
  - 20) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 01 32 00  
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Startup construction schedule.
  - 2. Contractor's Construction Schedule.
  - 3. Construction schedule updating reports.
  - 4. Daily construction reports.
  - 5. Material location reports.
  - 6. Site condition reports.
  - 7. Unusual event reports.
- B. Related Requirements:
  - 1. Section 014000 "Quality Requirements" for schedule of tests and inspections.
  - 2. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. Working electronic copy of schedule file.
  - 2. PDF file.
  - 3. Two paper copies, of sufficient size to display entire period or schedule, as required.
- B. Startup construction schedule.
  - 1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
  - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
  - 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
  - 2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.



3. Total Float Report: List of activities sorted in ascending order of total float.
  4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.
- H. Material Location Reports: Submit at weekly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Unusual Event Reports: Submit at time of unusual event.
- K. Qualification Data: For scheduling consultant.

#### 1.5 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
1. Secure time commitments for performing critical elements of the Work from entities involved.
  2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

#### 1.6 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
1. Use Primavera or scheduling component of Project management software package specified in Section 013100 "Project Management and Coordination," for current Windows operating system.
- B. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting, using CPM scheduling.
1. In-House Option: Owner may waive requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
  2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- C. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- D. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by RPR.
  2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
    - a. Securing of approvals and permits required for performance of the Work.
    - b. Temporary facilities.
    - c. Construction of mock-ups, prototypes and samples.
    - d. Owner interfaces and furnishing of items.
    - e. Interfaces with Separate Contracts.
    - f. Regulatory agency approvals.
    - g. Punch list.
  3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
    - a. Passenger Boarding Bridge (Alternate)
    - a. Counter Millwork (Alternate)
    - b. Diesel Generator (Alternate)
    - c. Split System Roof Top Units for HVAC systems
  4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
  5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
  6. Commissioning Time: Include no fewer than 15 days for commissioning.
  7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for RPR's administrative procedures necessary for certification of Substantial Completion.
  8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.
- E. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  4. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use-of-premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
  5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Mockups.
    - e. Fabrication.
    - f. Sample testing.
    - g. Deliveries.
    - h. Installation.
    - i. Tests and inspections.
    - j. Adjusting.
    - k. Curing.
    - l. Building flush-out.
    - m. Startup and placement into final use and operation.
    - n. Commissioning.
  6. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    - a. Structural completion.
    - b. Temporary enclosure and space conditioning.
    - c. Permanent space enclosure.
    - d. Completion of mechanical installation.
    - e. Completion of electrical installation.
    - f. Substantial Completion.
  7. Other Constraints:
    - a. Demolition
    - b. Foundations and underground utilities
    - c. Finishes
- F. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion, and the following interim milestones:

1. Temporary holdroom enclosure, space conditioning and occupancy.
  2. Permanent holdroom enclosure, space conditioning and occupancy.
- G. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- H. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
  2. Unanswered Requests for Information.
  3. Rejected or unreturned submittals.
  4. Notations on returned submittals.
  5. Pending modifications affecting the Work and the Contract Time.
- I. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate Final Completion percentage for each activity.
- J. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- K. Distribution: Distribute copies of approved schedule to RPR, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
  2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.
- 1.7 STARTUP CONSTRUCTION SCHEDULE
- A. Gantt-Chart Schedule: Not used.

## 1.8 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Not used.

## 1.9 CPM SCHEDULE REQUIREMENTS

- A. Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.
  - 1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
    - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
  - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
  - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  - 4. Use "one calendar day" as the unit of time for individual activities.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
  - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Preparation and processing of submittals.
    - b. Mobilization and demobilization.
    - c. Purchase of materials.
    - d. Delivery.
    - e. Fabrication.
    - f. Utility interruptions.
    - g. Installation.
    - h. Work by Owner that may affect or be affected by Contractor's activities.
    - i. Testing and inspection.
    - j. Commissioning.
    - k. Punch list and Final Completion.
    - l. Activities occurring following Final Completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
  - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
5. Cost- and Resource-Loading of CPM Schedule: If requested by the RPR, provide cost and resource loaded CPM schedule. Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain RPR's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
  - a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
  - b. Total cost assigned to activities shall equal the total Contract Sum..
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
  1. Contractor or subcontractor and the Work or activity.
  2. Description of activity.
  3. Main events of activity.
  4. Immediately preceding and succeeding activities.
  5. Early and late start dates.
  6. Early and late finish dates.
  7. Activity duration in workdays.
  8. Total float or slack time.
  9. Average size of workforce.
  10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
  1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.
  5. Changes in the critical path.

6. Changes in total float or slack time.
7. Changes in the Contract Time.

H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
  - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
  - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

1.10 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. Approximate count of personnel at Project site.
3. Equipment at Project site.
4. Material deliveries.
5. High and low temperatures and general weather conditions, including presence of rain or snow.
6. Testing and inspection.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
  2. Material stored prior to previous report and since removed from storage and installed.
  3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
- D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200



SECTION 01 32 30  
PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

Owner/RPR will be responsible for photographic documentation during construction. Pre-construction photographs will be the contractor responsibility.

- A. This Section includes administrative and procedural requirements for the following:
1. Preconstruction photographs.
  2. Periodic construction photographs.

1.2 SUBMITTALS

- A. Construction Photographs: Submit digital images of construction with description of locations and work being completed. Provide to the architect and owner weekly. Provide complete survey of work completed that week.
1. Digital Images: Submit a complete set of digital image electronic files via electronic file transfer. Submit images that have same aspect ratio as the sensor, uncropped.
  2. Identification: Provide the following information with each image description in file metadata tag:
    - a. Name of Project.
    - b. Name of RPR.
    - c. Name of Architect/Engineer.
    - d. Name of Contractor.
    - e. Date photograph was taken.
    - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
    - g. Unique sequential identifier keyed to accompanying key plan.

1.3 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 8.0 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in

focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
1. Date and Time: Include date and time in filename for each image.
  2. Field Office Images: Maintain one set of images on USB in the field office at Project site, available at all times for reference. Identify images same as for those submitted to RPR.
- C. Preconstruction Photographs: Before commencement of excavation, commencement of demolition, take color, digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by RPR.
1. Flag excavation areas before taking construction photographs.
  2. Take eight photographs to show existing conditions adjacent to property before starting the Work.
  3. Take eight photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
- D. Periodic Construction Photographs: Take digital photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- E. Additional Photographs: RPR may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
1. Three days' notice will be given, where feasible.
  2. In emergency situations, take additional photographs within 24 hours of request.
  3. Circumstances that could require additional photographs include, but are not limited to, the following:
    - a. Special events planned at Project site.
    - b. Immediate follow-up when on-site events result in construction damage or losses.
    - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or allowances.
    - d. Substantial Completion of a major phase or component of the Work.
    - e. Extra record photographs at time of final acceptance.
    - f. Owner's request for special publicity photographs.

END OF SECTION

SECTION 01 33 00  
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 RELATED SECTIONS

- A. Section 01 31 00 – Project Management and Coordination for progress meetings, schedules and related software
- B. Section 01 32 30 - Photographic Documentation for submitting construction photographs.
- C. Section 01 40 00 - Quality Requirements for submitting test and inspection reports.
- D. Section 01 77 00 - Closeout Procedures for submitting warranties.
- E. Section 01 78 20 - Operation and Maintenance Data for submitting operation and maintenance manuals.
- F. Section 01 79 00 - Demonstration and Training for submitting video of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires RPR's responsive action
- B. Informational Submittals: Written information that does not require RPR's responsive action. Submittals may be rejected for not complying with requirements.

1.4 ELECTRONIC SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that requires sequential activity.
  - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
  - 3. Without change to the Contract Duration, RPR reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- C. Summary:
  - 1. Shop drawing and product data submittals shall be transmitted to RPR in electronic (PDF) format using a website service designed specifically for transmitting submittals between construction team members.
  - 2. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.

3. The electronic submittal process is not intended for color samples, color charts, or physical material samples.
- D. Procedures:
1. Submittal Preparation - Contractor may use any or all of the following options:
    - a. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the submittal exchange website.
    - b. Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
    - c. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.
  2. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
  3. Contractor shall transmit each submittal to RPR using the website.
  4. Architect / Engineer review comments will be made available on the website for downloading. Contractor will receive email notice of completed review.
  5. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.
- E. Costs:
1. General Contractor shall include the full cost of the electronic document processing service subscription and printing of submittals in their proposal.
  2. Internet Service and Equipment Requirements:
    - a. Email address and Internet access at Contractor's main office.
    - b. Adobe Acrobat ([www.adobe.com](http://www.adobe.com)), Bluebeam PDF Revu ([www.bluebeam.com](http://www.bluebeam.com)), or other similar PDF review software for applying electronic stamps and comments.
- F. Processing Time: Allow enough time for submittal review, including time for resubmittals. Time for review shall commence on RPR's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals in sufficient time and advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. RPR will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 calendar days for review of each resubmittal.
  4. Sequential Review: Where sequential review of submittals by RPR, or other parties is required, allow 21 calendar days, excluding holidays, for initial review of each submittal.
  5. No extension of the Contract Time will be authorized because of failure to transmit submittals to RPR enough in advance of the Work to permit processing. Processing of incomplete or unacceptable submissions by RPR shall not reduce the number of calendar days specified above for RPR's review. Resubmissions shall be treated the same as initial submissions relative to review time.
  6. Notations on submittals that increase the Contract cost or time of completion shall be brought to RPR's attention before proceeding with the Work.
- G. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title

- block.
- 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by RPR, Owner and Architect/Engineer.
- 3. Include the following information on label for processing and recording action taken:
  - a. Project name.
  - b. Date.
  - c. Name and address of RPR.
  - d. Name and address of Architect.
  - e. Name and address of Contractor.
  - f. Name and address of subcontractor, if applicable.
  - g. Name and address of supplier, if applicable.
  - h. Name of manufacturer, if applicable.
  - i. Submittal number or other unique identifier, including revision identifier.
    - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.A).
  - j. Number and title of appropriate Specification Section.
  - k. Drawing number and detail references, as appropriate.
  - l. Location(s) where product is to be installed, as appropriate.
  - m. Transmittal number.
  - n. Other necessary identification.
  - o. Allow 15 calendar days, excluding holidays, for processing each re-submittal.
- H. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- I. Copies: In addition to submittal copies required at time of approved and project closeout and unless RPR observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
  - 1. Additional copies submitted for Operations and Maintenance manuals will be marked with action taken and will be returned.
- J. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. RPR will discard submittals received from sources other than Contractor.
  - 1. Transmittal Form: As approved by Owner and RPR.
- K. Resubmittals: Make resubmittals in same form as initial submittal.
  - 1. Note date and content of previous submittal.
  - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  - 3. Resubmit submittals until they are marked "Approved" or "Approved as Noted".
- L. Distribution: Contractor shall furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, and installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- M. Use for Construction: Use only final submittals with mark indicating "Approved" or "Approved as Noted" by RPR.

## 1.5 SUBMITTAL LOG

- A. Prepare a log that contains a complete listing of all submittals required by Contract. Submit the log at the preconstruction meeting along with Contractor's construction schedule specified in Division 01 Section "Construction Progress Documentation." Organize the submittal log by Section number. Assign each submittal a sequential number for identification and tracking purposes.
  - 1. Coordinate the submittal log with Division 01 Section "Construction Progress Documentation." The submittal log shall be submitted for RPR's review. Include the following information:
    - a. Title of submittal/description.
    - b. Submittal number (sequential).
    - c. Scheduled date for the first submittal.
    - d. Drawing number, if applicable.
    - e. Applicable Section number.
    - f. Name of subcontractor/vendor.
    - g. Scheduled date of RPR's final release or approval.

## PART 2 - PRODUCTS

### 2.1 ELECTRONIC DOCUMENT PROCESSING SERVICE

Owner will provide Procore subscription for use on this project.

### 2.2 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment. **Partial submittals shall be unacceptable.**
  - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
  - 2. Mark each copy of each submittal to show which products and options are applicable.
  - 3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's installation instructions.
    - d. Standard color charts
    - e. Manufacturer's catalog cuts.
    - f. Wiring diagrams showing factory-installed wiring.
    - g. Printed performance curves.
    - h. Operational range diagrams.
    - i. Mill reports.
    - j. Standard product operating and maintenance manuals.
    - k. Compliance with recognized trade association standards.
    - l. Compliance with recognized testing agency standards.
    - m. Compliance with specified referenced standards.
    - n. Testing by recognized testing agency.
    - o. Notation of coordination requirements.

4. Number of Copies: Unless submittal requires physical review, Contractor shall not be required to submit physical copies to the RPR. Contractor shall keep one printed copy of the approved/accepted submittal in the Contractor field office.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Dimensions.
    - b. Identification of products.
    - c. Fabrication and installation drawings.
    - d. Roughing-in and setting diagrams.
    - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    - f. Shop work manufacturing instructions.
    - g. Templates and patterns.
    - h. Schedules.
    - i. Notation of coordination requirements.
    - j. Notation of dimensions established by field measurement.
    - k. Relationship to adjoining construction clearly indicated.
    - l. Seal and signature of professional engineer if specified.
    - m. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
  2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
  3. Number of Copies: Unless requested, Contractor shall not be required to submit physical copies to the RPR. Contractor shall keep one printed copy of the approved/accepted shop drawing in the Contractor field office.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of appropriate Specification Section.
  3. Disposition: Maintain sets of approved Samples at Project site, available for quality- control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
  4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit four (4) full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
  5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples

include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit four (4) sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.
- E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location.
1. Number of Copies: Submit three (3) copies of product schedule or list, unless otherwise indicated. RPR will return two copies.
- F. Application for Payment: Comply with requirements in Division 01 Section "Application for Payment."
- G. Schedule of Values: Comply with requirements specified in General Conditions for Construction Contracts.
- H. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation."
- I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design.
1. Number of Copies: Submit copies of subcontractor list in accordance with this specification section.

## 2.3 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Provide two (2) approved "hard" copies on site for job reference.
  2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
  3. Test and Inspection Reports: Comply with requirements specified in Section 01 40 00 - Quality Requirements.
- B. Coordination Drawings: Comply with requirements when specified in individual sections.
- C. Contractor's Construction Schedule: Comply with requirements specified in the General Conditions for Construction Contracts.
- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where



required, is authorized by manufacturer for this specific Project.

- G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Section 01 78 20 - Operation and Maintenance Data.
- Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include professional certifications, as required, and page numbers.
- R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.
- S. Manufacturer's Field Reports: Prepare written information documenting factory-

authorized service representative's tests and inspections. Include the following, as applicable:

1. Statement on condition of substrates and their acceptability for installation of product.
  2. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
- T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- U. Construction Photographs: Comply with requirements specified in Section 01 32 30 - Photographic Documentation.

## 2.4 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to RPR.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to RPR.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 RPR'S ACTION

- A. General: RPR shall not review submittals that do not bear Contractor's approval stamp and shall return them without action.
- B. Action Submittals: RPR/Architect shall review each submittal, make marks to indicate corrections or modifications required, and return it. Architect shall stamp each submittal with an action stamp and shall mark stamp appropriately to indicate action taken, as follows:

1. Approved: Means fabrication/installation may be undertaken. Approval does not authorize changes to the Contract Price or the Contract Time.
  2. Approved as Noted: Same as "Approved," providing Contractor complies with corrections noted on submittal. Resubmission required only if Contractor is unable to comply with noted corrections.
  3. Revise and Resubmit: Fabrication and/or installation may not be undertaken. Make appropriate revisions and resubmit, limiting corrections to items marked.
  4. Rejected: Submittal does not comply with requirements. Fabrication and/or installation may not be undertaken. Prepare a new submittal according to requirements and submit without delay.
- C. Informational Submittals: RPR shall review each submittal and will not return it or will return it if it does not comply with requirements. RPR shall forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, shall be considered nonresponsive, and shall be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

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SECTION 01 40 00  
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality- assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 2. Requirements for Contractor to provide quality-assurance and -control services required by RPR, Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Section 01 41 00 – Inspection and Testing Laboratory Services for inspection testing laboratory requirements.
- D. See Divisions 02 through 34 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by RPR.
- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.
- I. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

### 1.3 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to RPR for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to RPR for a decision before proceeding.

### 1.4 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Reports: Prepare and submit certified written reports that include the following:
1. Date of issue.
  2. Project title and number.
  3. Name, address, and telephone number of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and re-inspecting.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## 1.5 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Owner/RPR.
  - 2. Notify Owner/RPR seven days in advance of dates and times when mockups will be constructed.
  - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 4. Obtain RPR and Architect's approval of mockups before starting work, fabrication, or construction.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

## 1.6 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
  1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractors Responsibilities: Tests and inspections not explicitly assigned to Owner are the Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  1. Where services are indicated, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. Retesting / Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with RPR and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  1. Notify Owner, RPR and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.



- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## 1.7 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
  2. Notifying RPR and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  3. Submitting a certified written report of each test, inspection, and similar quality-control service to RPR with copy to Contractor and to authorities having jurisdiction.
  4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  6. Retesting and re-inspecting corrected work.

## PART 2 - PRODUCTS

(Not Used)

## PART 3 - EXECUTION

### 3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
  2. Comply with the Contract Document requirements for Division 01 Section

"Execution."

- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

3.2 SCHEDULE OF MOCK-UPS

- A. Exterior Wall Section (Metal Stud Back Up): 8'-0" H x 8'-0" W illustrating architectural stone veneer, CMU back up, 2'-0" x 2'-0" window unit and all associated construction materials, metal studs and sheathing.
- B. Floor tile system with expansion joints, grout, trim, crack isolation membrane, thresholds and wall base. Illustrate proposed pattern with all colors and styles.

END OF SECTION

SECTION 01 41 00  
INSPECTION AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

- A. Selection and payment.
- B. Laboratory responsibilities.
- C. Laboratory reports.
- D. Limits on testing laboratory authority.
- E. Contractor responsibilities.
- F. Schedule of inspections and tests.

1.3 RELATED SECTIONS

- A. Section 01 33 00 – Submittals: Manufacturer's certificates.
- B. Section 01 40 00 – Quality Requirements.
- C. Section 02 01 00 – Subsurface Soil Exploration.

1.4 REFERENCES

- A. ANSI/ASTM D 3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ANSI/ASTM E 329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.5 SELECTION AND PAYMENT

- A. The Contractor will coordinate, employ and pay for services of an independent testing laboratory to perform specified inspection and testing as identified within the specifications. This effort shall be instituted by the Contractor as part of the Contractor's Quality Control (CQCP) program.
- B. Employment of a separate testing laboratory (CITF) by the Owner for Quality Assurance (QA) shall in no way relieve Contractor of obligation to perform work in compliance with requirements of Contract Documents.

1.6 LABORATORY RESPONSIBILITIES

- A. Test samples of mixes submitted by Contractor to testing laboratory.

- B. Provide qualified personnel at site. Cooperate with Owner/RPR and Contractor in performance of services.
- C. Perform specified inspection, sampling, and testing of products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Contractor and Owner's Representative of observed irregularities or non-conformance of Work or products.
- F. Perform additional inspections and tests required by RPR.
- G. Attend preconstruction conferences and progress meetings.

#### 1.7 LABORATORY REPORTS

- A. After each inspection and test, promptly submit 4 copies of laboratory report to Contractor, with copies sent directly to the Owner, RPR, the Architect, the Civil Engineer, the Structural Engineer and other consultant engineers associated with the specification Section.
- B. Include:
  - 1. Data issued.
  - 2. Project title and number.
  - 3. Name of inspector.
  - 4. Date and time of sampling or inspection.
  - 5. Identification of product and Specification Section.
  - 6. Location in the Project.
  - 7. Type of inspection or test.
  - 8. Date of test.
  - 9. Results of tests.
  - 10. Compliance with Contract Documents.
- C. When requested by RPR or Architect/Engineer, provide interpretation of test results.

#### 1.8 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of the Work.
- C. Laboratory may not assume any duties of Contractor.
- D. Laboratory has no authority to stop the Work unless life-threatening health or safety conditions exist. The laboratory shall notify the RPR, Owner and Contractor immediately.

#### 1.9 CONTRACTOR RESPONSIBILITIES

- A. Deliver to laboratory at agreed upon location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.

- B. Cooperate with laboratory personnel, inclusive of Owner's CITF for QA and provide access to the Project.
- C. Provide incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the site or at source of products to be tested, and to facilitate tests and inspections, storage and curing of test samples.
- D. Notify RPR and his quality assurance (CITF) and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.

## PART 2 PRODUCTS

(Not Used)

## PART 3 EXECUTION

### 3.1 SCHEDULE OF INSPECTIONS AND TESTS

The following list is not meant to be all inclusive. The Contractor shall produce a schedule of all inspections, test, balancing, etc. in compliance with the Contract Documents and the individual specification sections.

- A. Section 03 30 00 – Cast-in-Place Concrete: Requirements for Reinforcing Steel Placement (Owner).
- B. Section 03 30 00 - Cast-in-Place Concrete: Requirements for sampling and testing concrete materials and reinforcing steel placement (Owner).
- C. Section 04 10 00 – Masonry Mortar and Grout: Requirements for sampling and testing mortar and grout cubes (Owner)
- D. Section 05 12 00 - Structural Steel Framing: Testing of connections and verification of member sizes (Owner).
- E. Section 05 31 00 - Steel Decking: Field inspection of deck profile span orientation and connections (Owner).
- F. Section 22 11 16 – Domestic Water Piping: Requirements for system testing.
- G. Section 22 11 16 – Domestic Water Piping: Field Quality Control (Tests furnished by the Plumbing Contractor)
- H. Section 22 13 16 – Sanitary Waste and Vent Piping: Requirements for system testing.
- I. Section 23 05 01 – Mechanical Firestopping: Inspection report (Owner).
- J. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC (Tests furnished by the Mechanical Contractor)
- K. Section 26 05 00 – Common Work Results for Electrical: Field Quality Control, Acceptance Testing (Tests furnished by the Electrical Contractor)
- L. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Field Quality Control, Acceptance Testing (Tests furnished by the Electrical Contractor)

- M. Section 26 22 00 - Low Voltage Transformers: Field Quality Control, Acceptance Testing.  
(Tests furnished by the Electrical Contractor)
- N. Section 26 32 13 – Engine Generators: Field Quality Control, Site Tests  
(Tests furnished by the Electrical Contractor)
- O. Section 26 36 00 - Transfer Switches: Field Quality Control, Acceptance Testing (Tests  
furnished by the Electrical Contractor)
- P. Section 28 23 10 – Security Intercom: Field Quality Control, Acceptance Testing  
Tests furnished by the Electrical Contractor)
- Q. Section 28 31 11 – Fire Alarm System: Manufacturer’s Field Services. (Tests furnished by the  
Electric Contractor)

END OF SECTION

SECTION 01 42 00  
REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey RPR's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by RPR. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

- D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

ADAAG	Americans with Disabilities Act
(ADA)	Architectural Barriers Act (ABA)
CFR	Code of Federal Regulations
CRD	Handbook for Concrete and Cement
DOD	Department of Defense Military Specifications and Standards
DSCC	Defense Supply Center Columbus (See FS)
FED-STD	Federal Standard (See FS)
FS	Federal Specification
FTMS	Federal Test Method Standard (See FS)
ICC-ES	ICC Evaluation Service, Inc.
MIL	(See MILSPEC) MIL-STD (See MILSPEC)
MILSPEC	Military Specification and Standards
NES	National Evaluation Service (See ICC-ES)
UFAS	Uniform Federal Accessibility Standards

### 1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

AA	Aluminum Association, Inc. (The)
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ABMA	American Bearing Manufacturers Association
ACI	ACI International (American Concrete Institute)
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies, Inc.
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AGC	Associated General Contractors of America
AHA	American Hardboard Association (Now part of CPA)
AHAM	Association of Home Appliance Manufacturers
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction AISI American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALCA	Associated Landscape Contractors of America
ALSC	American Lumber Standard Committee, Incorporated
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts
APA	The Engineered Wood Association



APA	Architectural Precast Association
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute
ARMA	Asphalt Roofing Manufacturers Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	The American Society of Mechanical Engineers
ASME International	(The American Society of Mechanical Engineers International)
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (American Society for Testing and Materials International)
AWCI	
AWCI International	(Association of the Wall and Ceiling Industries International)
AWCMA	American Window Covering Manufacturers Association (Now WCSC)
AWI	Architectural Woodwork Institute
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
BICSI	
BIFMA	Business and Institutional Furniture Manufacturers Association
BIFMA International	Business and Institutional Furniture Manufacturer's Association International)
BISSC	Baking Industry Sanitation Standards Committee
CCC	Carpet Cushion Council
CDA	Copper Development Association Inc.
CEA	Canadian Electricity Association
CFFA	Chemical Fabrics & Film Association, Inc.
CGA	Compressed Gas Association
CGSB	Canadian General Standards Board
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CPA	Composite Panel Association
CPPA	Corrugated Polyethylene Pipe Association
CRI	Carpet & Rug Institute (The)
CRSI	Concrete Reinforcing Steel Institute
CSA International	- Formerly: IAS - International Approval Services)
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)
DHI	Door and Hardware Institute
EIA	Electronic Industries Alliance
EIMA	
EIFS	Industry Members Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.

ESD	ESD Association
FCI	Fluid Controls Institute
FIBA	Federation Internationale de Basketball Amateur (The International Basketball Federation)
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation)
FM	Factory Mutual System (Now FMG)
FMG	FM Global (Formerly: FM - Factory Mutual System)
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.
FSA	Fluid Sealing Association FSC Forest Stewardship Council
GA	Gypsum Association
GANA	Glass Association of North America
GBC	Green Building Council
GRI	(Now GSI) GS Green Seal
GSI	Geosynthetic Institute
HI	Hydraulic Institute
HI	Hydronics Institute
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.
IAS	International Approval Services (Now CSA International)
IBF	International Badminton Federation
ICEA	Insulated Cable Engineers Association, Inc.
ICRI	International Concrete Repair Institute, Inc.
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IESNA	Illuminating Engineering Society of North America
IGCC	Insulating Glass Certification Council
IGMA	Insulating Glass Manufacturers Alliance
ILI	Indiana Limestone Institute of America, Inc.
ISO	International Organization for Standardization
ISSFA	International Solid Surface Fabricators Association
ITS	Intertek
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LMA	Laminating Materials Association (Now part of CPA)
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturers Association
MFMA	Maple Flooring Manufacturers Association
MFMA	Metal Framing Manufacturers Association
MH	Material Handling (Now MHIA)
MHIA	Material Handling Industry of America
MIA	Marble Institute of America
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International - National Association of Corrosion Engineers International)

NADCA	National Air Duct Cleaners Association
NAGWS	National Association for Girls and Women in Sport
NAIMA	North American Insulation Manufacturers Association
NBGQA	National Building Granite Quarries Association, Inc.
NCAA	National Collegiate Athletic Association
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute
NCARB	National Council of Architectural Registration Boards
NCTA	National Cable & Telecommunications Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFHS	National Federation of State High School Associations
NFPA	National Fire Protection Association
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	National Oak Flooring Manufacturers Association
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	
NSF International	National Sanitation Foundation International
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc.
NTRMA	National Tile Roofing Manufacturers Association (Now RTI)
NWWDA	National Wood Window and Door Association (Now WDMA)
OPL	Omega Point Laboratories, Inc.
PCI	Precast / Prestressed Concrete Institute
PDCA	Painting & Decorating Contractors of America
PDI	Plumbing & Drainage Institute
PGI	PVC Geomembrane Institute
PTI	Post-Tensioning Institute
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service
RTI	(Formerly: NTRMA - National Tile Roofing Manufacturers Association) (Now TRI)
SAE	
SAE International	
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SEI	Structural Engineering Institute
SGCC	Safety Glazing Certification Council
SIA	Security Industry Association
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMPTE	Society of Motion Picture and Television Engineers

SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division)
SPIB	Southern Pine Inspection Bureau (The)
SPI/SPFD	Society of the Plastics Industry, Inc. (The) Spray Polyurethane Foam Division (Now SPFA)
SPRI	Single Ply Roofing Institute
SSINA	Specialty Steel Industry of North America
SSPC	The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
SWRI	Sealant, Waterproofing, & Restoration Institute
TCA	Tile Council of America, Inc.
TIA/EIA	Telecommunications Industry Association / Electronic Industries Alliance
TMS	The Masonry Society
TPI	Truss Plate Institute, Inc.
TPI	Turfgrass Producers International
TRI	Tile Roofing Institute (Formerly: RTI - Roof Tile Institute)
UL	Underwriters Laboratories Inc.
UNI	Uni-Bell PVC Pipe Association
USAV	USA Volleyball
USGBC	U.S. Green Building Council
USITT	United States Institute for Theatre Technology, Inc.
WASTEC	Waste Equipment Technology Association
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association (Now WCSC)
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association)
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association)
WI	Woodwork Institute (Formerly WIC - Woodwork Institute of California)
WIC	Woodwork Institute of California (Now WI)
WMMPA	Wood Moulding & Millwork Producers Association
WSRCA	Western States Roofing Contractors Association
WWPA	Western Wood Products Association

- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contracts Documents, they shall mean the recognized name of the entities in the following list.

BOCA	BOCA International, Inc. (Now ICC)
CABO	Council of American Building Officials (Now ICC)
IAPMO Officials	International Association of Plumbing and Mechanical
ICBO	International Conference of Building Officials (Now ICC)
ICBO ES	ICBO Evaluation Service, Inc. (Now ICC-ES)
ICC	International Code Council (Formerly: CABO - Council of American Building Officials) ICC-ES ICC Evaluation Service, Inc.
NES	National Evaluation Service (Now ICC-ES)
SBCCI	Southern Building Code Congress International, Inc. (Now ICC)

- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

CE	Army Corps of Engineers
CPSC	Consumer Product Safety Commission
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FDA	Food and Drug Administration
GSA	General Services Administration
HUD	Department of Housing and Urban Development
LBL	Lawrence Berkeley National Laboratory
NCHRP	National Cooperative Highway Research Program (See TRB)
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety & Health Administration
PBS	Public Building Service (See GSA)
PHS	Office of Public Health and Science
RUS	Rural Utilities Service (See USDA)
SD	State Department
TRB	Transportation Research Board
USDA	United States Department of Agriculture
USPS	United States Postal Service

- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

DGS	Department of General Services
DLLR	Department of Licensing and Labor Regulation
DNR	Department of Natural Resources
MAA	Maryland Aviation Administration
MDARNG	Maryland Army National Guard
MDE	Maryland Department of the Environment
MDOT	Maryland Department of Transportation
SHA	State Highway Administration

## PART 2 – PRODUCTS

(Not Used)

## PART 3 - EXECUTION

(Not Used)

END OF SECTION

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SECTION 01 50 00  
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. See Item C-102, Temporary Air and Water Pollution, Soil Erosion, and Siltation Control for additional Environmental Control and Protection requirements.

1.2 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
  - 1. Sewers and drainage.
  - 2. Water service and distribution.
  - 3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
  - 4. Heating and cooling facilities.
  - 5. Ventilation.
  - 6. Electric power service.
  - 7. Lighting.
  - 8. Telephone service.
- B. Support facilities include, but are not limited to, the following:
  - 1. Dewatering facilities and drains.
  - 2. Project identification and temporary signs.
  - 3. Temporary interior partitions.
  - 4. Waste disposal facilities.
  - 5. Field offices.
  - 6. Storage and fabrication sheds.
  - 7. Construction aids and miscellaneous services and facilities.
- C. Security and protection facilities include, but are not limited to, the following:
  - 1. Environmental protection.
  - 2. Stormwater control.
  - 3. Pest and rodent control.
  - 4. Security enclosure and lockup.
  - 5. Barricades, warning signs, and lights.
  - 6. Fire protection.
- D. Related Sections include the following:
  - 1. Section 01 10 00 - Summary for limitations on utility interruptions and other work restrictions.
  - 2. Section 01 33 00 - Submittal Procedures for submitting copies of implementation and termination schedule and utility reports.
  - 3. Section 01 73 00 - Execution for progress cleaning requirements.
  - 4. Divisions 02 through 34 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.
  - 5. Section 31 12 00 - Flexible Paving for construction and maintenance of asphalt paving for temporary roads and paved areas.
  - 6. Section 32 13 00 - Rigid Paving for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

### 1.3 DEFINITIONS

- A. Permanent Enclosure: As determined by RPR, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

### 1.4 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner or RPR and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
  - 1. RPR.
  - 2. Architect.
  - 3. County and State personnel.
  - 4. Testing agencies.
  - 5. Personnel of authorities having jurisdiction.
- B. Sewer Service: Pay sewer service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.
- D. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

### 1.5 SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel. Any changes to the approved site plan will require approval of the RPR.
- B. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- C. Implementation and Termination Schedule: Within 15 days of date established for submittal of Contractor's Construction Schedule, submit a schedule indicating implementation and termination of each temporary utility.

### 1.6 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

### 1.7 PROJECT CONDITIONS

- A. Temporary Utilities: At earliest feasible time, when acceptable to RPR/Owner, change over from use of temporary service to use of permanent service.
  - 1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.



## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Pavement: Comply with Requirements in Division 32.
- B. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with galvanized barbed-wire top strand.
- C. Lumber and Plywood: Comply with requirements in Division 06 Section "Finish Carpentry."
- D. Gypsum Board: Minimum 1/2-inch-thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.
- E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- F. Paint: Comply with requirements in Division 09 Painting.
- G. Temporary Low-Profile Barricades and Lights: See plan sheet GN03.500 – Safety Phasing Notes and Details for requirements of barricades and temporary lights.

### 2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Not required.
- B. Common-Use Field Office: As required for use by contractor personnel.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
  - 1. Store combustible materials apart from building.

### 2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

- B. Provide each facility ready for use when needed to avoid delay. Do not remove facilities until they are approved to be removed by the RPR and are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, RPR, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
  - 1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
  - 2. Connect temporary sewers to municipal system as directed by sewer department officials.
  - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
  - 4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
  - 1. Install electric power service underground, unless otherwise indicated.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
  - 2. Install lighting for Project identification sign.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
  - 1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with latest NFPA Regulations.
  - 2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved area within construction limits indicated on Drawings.
  - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
  - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 31 23 23.13 – Backfilling.
  - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
  - 4. Provide adequate positive drainage, without standing water or ponding.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
  - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide temporary parking areas for construction personnel in areas shown on the drawings and approved by the RPR.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
  - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
  - 2. Remove snow and ice as required to minimize accumulations.
- F. Project Identification and Temporary Signs: Prepare Project identification and other signs in accordance with the MDOTSHA and MUTCD requirements. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.
  - 1. Provide temporary, directional signs for construction personnel and visitors.
  - 2. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal." Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
  - 1. Comply with work restrictions specified in Section 01 10 00 – Summary.
- B. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Section 31 10 00 - Site Clearing.
- C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

- E. Site Enclosure Fence: Not used.
- F. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
- I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
  - 1. Prohibit smoking on the construction site.
  - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
  - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

### 3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Operate Project-identification-sign lighting daily from dusk until 12:00 A.M. Continuously monitor and maintain all temporary lighting on barricades and warning signs.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  - 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 - Closeout Procedures.

END OF SECTION

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SECTION 01 54 60  
SAFETY AND HEALTH

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. Code of Federal Regulations (CFR):
  - 1. OSHA General Industry Safety and Health Standards (29 CFR 1910), Publication V2206; OSHA Construction Industry Standards (29 CFR 1926).
  - 2. National Emission Standards for Hazardous Air Pollutants (40 CFR, Part 61).
  - 3. Environmental Protection Agency (EPA) Final Rule (40 CFR Part 761) dated July 17, 1985.
- C. Federal Standard (Fed. Std):
  - 1. 313A Material Safety Data Sheets, Preparation and the Submission of.
- D. Maryland Standards:
  - 1. Maryland Occupational Safety and Health (MOSH) Supplement to OSHA.

1.3 WORK COVERED BY THIS SECTION

- A. This section is applicable to all work.
- B. A Site-Specific Safety and Health Plan is to be developed by the Contractor and shall be adhered to in the execution of the work. The Plan shall include an overview of procedures, reports and samples of forms and documents for the plan. The contractor shall provide a copy of his safety plan to the RPR.

1.4 DEFINITION OF HAZARDOUS MATERIALS

- A. Refer to hazardous and toxic materials/substances included in Subparts H and Z of 29 CFR 1910; and to others as additionally defined in Fed. Std. 313. Those most commonly encountered include asbestos, polychlorinated biphenyls (PCB's), explosives, and radioactive material, but many include others. The most likely products to contain asbestos are sprayed-on fireproofing, insulation, boiler lagging, pipe covering and likely products to contain PCB's are transformers, capacitors, voltage regulators, and oil switches.

1.5 QUALITY ASSURANCE

- A. Safety Meeting: Representatives of the Contractor shall meet with the Owner and his/her representative(s) prior to the start of work under this contract for the purpose of reviewing the Contractor's safety and health programs and discussing implementation of all safety and health provisions pertinent to the work to be performed under the contract. The Contractor shall be prepared to discuss in detail, the measures he/she intends to take in order to control any unsafe or unhealthy conditions associated with the work to be performed under the contract. If directed by the Owner, this meeting may be held in conjunction with other meetings which are scheduled to take place prior to start of work under this contract. The level of detail for the safety meeting is dependent upon the nature of the work and the potential inherent hazards. The Contractor's principal on-site representative(s), the general superintendent and his/her safety representative(s) shall attend this meeting.

- B. Compliance with Regulations: All work, including contact with and handling of hazardous materials, the disturbance or dismantling of structures containing hazardous materials and/or the disposal of hazardous materials shall comply with the applicable requirements of 29 CFR 1926/1910 and 40 CFR 761. All work shall comply with applicable state and municipal safety and health requirements. Where there is a conflict between applicable regulations, the most stringent shall apply.
- C. Contractor Responsibility: The Contractor shall assume full responsibility and liability for compliance with all applicable regulations pertaining to the health and safety of personnel during the execution of work and shall hold the Owner harmless for any action on his/her part or that of his/her employees or subcontractors, which results in illness, injury or death.
- D. Contractor shall conduct activities in a safe manner and shall be responsible for observing the safety regulations of MOSH, OSHA, and local life safety agencies.
  - 1. Comply with all applicable laws, ordinances, rules, regulations, and orders of the governing authorities having jurisdiction for safety of persons and property to protect them from damage, injury, or loss.
  - 2. Erect and maintain as required by conditions and progress of the work all necessary safeguards for safety and protection, including fences, railings, barricades, lighting, posting of danger signs, and other warnings against hazards.
  - 3. Be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with this project.
  - 4. Contractor shall immediately provide and maintain properly secured and labeled temporary protective covers over all deck and roof penetrations and openings until permanent work is installed.
- E. Contractor shall furnish any and all relevant SDS (Safety Data Sheets) information as related to their scope of work prior to starting. If not on file, this Contractor will not be permitted to work. Resulting delays and associated cost shall be the responsibility of this Contractor including costs incurred by other parties.
- F. The General Contractor will require all contractors to complete a “Permit to Work” for high risk activities such as: crane erection and dismantling, entry into confined spaces, hot works, works on or adjacent to energized systems, and work on occupied premises. The Contractor shall present a Job Hazard Analysis and safe work method statement prior to the issuance of a Permit to Work. These items will be required in the project specific safety plan required for all Contractors.
- G. All Contractors acknowledge that safety harnesses must only be used as a secondary means of fall prevention / fall restraint or as a last resort when no other practical means are available to provide a safe method of work. Passive fall protection such as safe work platforms, scaffolding, robust perimeter protection, and Mobile Elevated Work Platforms must be used wherever possible to prevent the use of safety harnesses as a primary means of fall protection.
- H. Contractor shall conduct weekly tool box safety meetings and shall require all of their employees working on the site to attend. Copies of the minutes and attendance sheet must be submitted to the General Contractor weekly.
- I. All Contractors shall provide proof of training and certification for all employees assigned to this project. Training must be relevant and updated for the scope of work or equipment being performed or operated by the individual tradesmen.
- J. Contractor acknowledges that all employees are required to wear shirts, work shoes, and hard hats, safety glasses and high visibility vest at all times while on site. No shorts will be permitted.
- K. Contractors shall install and maintain safety fence at all open excavations that they create.



- L. Contractor shall exercise due care and shall be responsible for all material and accessories required for the safe rigging and handling of material and equipment so as to provide for the safety of persons and property, the work of other trades, and material and equipment stored at the jobsite.
- M. Contractor shall replace any safety handrails and barriers taken down or removed during the process of their work.
- N. Safety shall be a standing discussion item at the Construction Progress Meeting.
- O. Site-Specific Safety and Health Plan: The Contractor's Safety and Health Plan is to be submitted for approval during the initial submittals for the project upon receipt of Notice to Proceed.
- P. Accident Reporting: A copy of each accident report, which the Contractors or subcontractors submit to their insurance carriers, shall be forwarded to the Owner as soon as possible, but in no event later than seven (7) calendar days after the day the accident occurred.
- Q. Permits: If hazardous materials are disposed of off-site, submit copies of permits from applicable, Federal, state or municipal authorities and necessary certificates that the material has been disposed of as per regulations.
- R. Other Submittals: If agreed to in writing at the safety meeting, other submittals shall be required. One such submittal which may be included is a plan of action for handling hazardous materials, which shall contain the following:
  - 1. Number, type, and experience of employees to be used for the work
  - 2. Description of how applicable safety and health regulations and standards are to be met.
  - 3. Type of protective equipment and work procedures to be used
  - 4. Emergency procedures for accidental spills or exposures
  - 5. Procedures for disposing of or storing the toxic/hazardous materials
  - 6. Identification of possible hazards, problems, and proposed control mechanisms
  - 7. Protection of public or others not related to the operation
  - 8. Interfacing and control of subcontractors, if any
  - 9. Identifications of any required analyses, test demonstrations, and validation requirements.
  - 10. Method of certification for compliance

## PART 2 PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

- A. Special facilities, devices, equipment, clothing, and similar items used by the Contractor in the execution of work shall comply with the applicable regulations.

## PART 3 EXECUTION

### 3.1 GENERAL

- A. Material Safety Data Sheets: Safety Data Sheets (SDS) shall be kept on file in the Contractor's Field Office and made available for review when required.

### 3.2 SAFETY AND HEALTH PLAN

- A. Site-Specific Safety and Health Plan: Post copies of the plan in conspicuous location so that all personnel may be made aware of the safety procedures at all times.

### 3.3 STOP WORK ORDERS

- A. When the Contractors or his/her subcontractors are notified by the Owner/Architect of any noncompliance with the provisions of the contract and the action(s) to be taken, the Contractor shall immediately, if so directed, or within 48 hours after receipt of a notice of violation correct the unsafe or unhealthy condition. If the Contractor fails to comply promptly, all or any part of the work being performed may be stopped by the Owner/Architect with a “Stop Work Order”. When, in the opinion of the Owner/Architect, satisfactory corrective action has been taken to correct the unsafe and unhealthy condition, a start order will be given immediately. The Contractor shall not be allowed any extension of time or compensation for damages by reason of or in connection with such work stoppage.

### 3.4 PROTECTION

- A. The Contractor shall take all necessary precautions to prevent injury to the public, or damage to property of others. For the purposes of this contract, the public shall include all persons not employed by the Prime Contractor’s or a subcontractor working under his/her direction.
- B. Storing, positioning or use of equipment, tools, materials, scraps, and trash in a manner likely to present a hazard to the public by its accidental shifting, ignition, or other hazardous qualities is prohibited.
- C. Public Thoroughfare: When work is to be performed over a public thoroughfare such as a sidewalk, the thoroughfare shall be closed, if possible, or other precautions taken such as the installation of screen or barricades. When the exposure to heavy falling objects exists, as during the erection of building walls, special protection of the type detailed in 29 CFR 1910/1926 shall be provided.
- D. Fences and barricades shall be removed upon completion of the project, in accordance with local ordinance and to the satisfaction of the General Contractor.

END OF SECTION

SECTION 01 60 00  
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.
  - 2. Section 012300 "Alternates" for products selected under an alternate.
  - 3. Section 014200 "References" for applicable industry standards for products specified.
  - 4. Section 01770 "Closeout Procedures" for submitting warranties.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
  - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
  1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
  2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

#### 1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
  1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
  2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
    - a. Name of product and manufacturer.
    - b. Model and serial number.
    - c. Capacity.
    - d. Speed.
    - e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

## 1.5 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

### B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

### C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
  3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," RPR/Architect will make selection.
  5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
  6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
    - a. Submit additional documentation required by RPR/Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the RPR/Architect, whose determination is final.
- B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
  - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
  - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
  - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
  - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.
  1. Select products for which sustainable design documentation submittals are available from manufacturer.

## 2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: RPR/Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
  1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
  5. Samples, if requested.
- B. RPR/Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
  1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."



2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by the RPR and Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to RPR and Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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SECTION 01 73 00  
EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of Owner's portion of the Work.
  - 6. Coordination of Owner-installed products.
  - 7. Progress cleaning.
  - 8. Starting and adjusting.
  - 9. Protection of installed construction.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for coordination of Owner-furnished products, and limits on use of Project site.
  - 2. Section 013300 "Submittal Procedures" for submitting surveys.
  - 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
  - 4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

#### 1.4 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.

1. Prior to submitting cutting and patching plan, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform RPR of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
  - a. Contractor's superintendent.
  - b. Trade supervisor responsible for cutting operations.
  - c. Trade supervisor(s) responsible for patching of each type of substrate.
  - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.
2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

B. Layout Conference: Conduct conference at Project site.

1. Prior to establishing layout of new and existing perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform RPR of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:
  - a. Contractor's superintendent.
  - b. Professional surveyor responsible for performing Project surveying and layout.
  - c. Professional surveyor responsible for performing site survey serving as basis for Project design.
2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certified Surveys: Submit two copies signed by land surveyor.
- C. Certificates: Submit certificate signed by land surveyor, certifying that location and elevation of improvements comply with requirements.
- D. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
  1. Extent: Describe reason for and extent of each occurrence of cutting and patching.

2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
  3. Products: List products to be used for patching and firms or entities that will perform patching work.
  4. Dates: Indicate when cutting and patching will be performed.
  5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
    - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
- E. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

## 1.6 CLOSEOUT SUBMITTALS

- A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

## 1.7 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."
- C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect, through RPR, of locations and details of cutting and await directions from RPR before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
  2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    - a. Primary operational systems and equipment.
    - b. Fire separation assemblies.
    - c. Air or smoke barriers.
    - d. Fire-suppression systems.
    - e. Plumbing piping systems.
    - f. Mechanical systems piping and ducts.

- g. Control systems.
    - h. Communication systems.
    - i. Fire-detection and -alarm systems.
    - j. Conveying systems.
    - k. Electrical wiring systems.
    - l. Operating systems of special construction.
    - m. Security systems (employees, passenger screening and baggage screening)
  - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
    - a. Water, moisture, or vapor barriers.
    - b. Membranes and flashings.
    - c. Exterior curtain-wall construction.
    - d. Sprayed fire-resistive material.
    - e. Equipment supports.
    - f. Piping, ductwork, vessels, and equipment.
    - g. Noise- and vibration-control elements and systems.
  - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in RPR/Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
  - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to RPR/Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
  - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
  - 1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
  - 2. List of detrimental conditions, including substrates.
  - 3. List of unacceptable installation tolerances.
  - 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to RPR in accordance with requirements in Section 013100 "Project Management and Coordination."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify RPR promptly.
- B. Engage a land surveyor experienced in laying out the Work but not involved in the Project Design, using the following accepted surveying practices:
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish limits on use of Project site.
  - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 4. Inform installers of lines and levels to which they must comply.
  - 5. Check the location, level and plumb, of every major element as the Work progresses.
  - 6. Notify RPR when deviations from required lines and levels exceed allowable tolerances.
  - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and



duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by RPR.

### 3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Do not change or relocate existing benchmarks or control points without prior written approval of RPR. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to RPR before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

### 3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
  - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

- C. Install products at the time and under conditions that will ensure satisfactory results as judged by RPR. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by RPR.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by RPR. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
  - 1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

### 3.6 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by RPR/Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

- A. Site Access: Provide access to Project site for Owner's construction personnel.
1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
  2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed products
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### 3.8 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
  5. Recycle materials in accordance with Section 01 74 19 "Construction Waste Management and Disposal".
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal".
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.9 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with Airport Maintenance and RPR.

- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

## SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging nonhazardous demolition and construction waste.
  - 2. Recycling nonhazardous demolition and construction waste.
  - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
  - 1. Section 041000 "Unit Masonry Assemblies" for disposal requirements for masonry waste.
  - 2. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

#### 1.3 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 14 days of date established for the Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For waste management coordinator and refrigerant recovery technician.
- B. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- C. Refrigerant Recovery: Comply with requirements in Section 024119 "Selective Demolition" for refrigerant recovery submittals.

1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.
- B. Refrigerant Recovery Technician Qualifications: Comply with requirements in Section 024119 "Selective Demolition."
- C. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 RECYCLING RECEIVERS AND PROCESSORS

- A. Subject to compliance with requirements, available recycling receivers and processors include, but are not limited to, the following:



1. Republic Services  
11710 Greencastle Pike, Hagerstown MD 21740  
(301)223-7272

### PART 3 - EXECUTION

#### 3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
  1. Distribute waste management plan to everyone concerned within three days of submittal return.
  2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
  2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- E. Waste and Recycling Removal: Waste shall be removed from site periodically, but at no greater interval than weekly. Contractor shall remove waste and recycling at increased intervals as directed by the RPR.

#### 3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  - 2. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

### 3.3 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Paint: Seal containers and store by type.

### 3.4 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.
- C. Burning: Do not burn waste materials.

- D. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

END OF SECTION 017419

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## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
- B. Related Requirements:
  - 1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
  - 2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
  - 3. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
  - 4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 5. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.
  - 6. See Divisions 02 through 34 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

#### 1.3 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.

- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

#### 1.7 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
  - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by RPR. Label with manufacturer's name and model number.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain RPR's signature for receipt of submittals.
  - 5. Submit testing, adjusting, and balancing records.
  - 6. Submit sustainable design submittals not previously submitted.
  - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
  6. Advise Owner of changeover in utility services.
  7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements.
  10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and RPR will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for Final Completion.

## 1.8 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
  2. Certified List of Incomplete Items: Submit certified copy of Architect and RPR's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by both Architect and RPR. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report.
  5. Submit Final Completion photographic documentation.

- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and RPR will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
  - 1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.9 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  - 1. Organize list of spaces in sequential order, starting with exterior areas first, listed by room or space number.
  - 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
  - 3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect and RPR.
    - d. Name of Contractor.
    - e. Page number.
  - 4. Submit list of incomplete items in the following format:
    - a. MS Excel Electronic File: Architect and RPR will return annotated file.

#### 1.10 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of RPR and Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
  - 1. Submit on digital media acceptable to RPR and Architect.



E. Warranties in Paper Form:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

F. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural

- weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
  - i. Vacuum and mop concrete.
  - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain. If soil or stains cannot be removed to Owner or RPR approval, replace carpeted areas stained or soiled by construction activities.
  - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - l. Remove labels that are not permanent.
  - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - p. Clean ducts, blowers, and coils that display contamination with particulate matter on inspection.
    - 1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
  - q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
  - r. Clean strainers.
  - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 017419 "Construction Waste Management and Disposal."
- 3.2 REPAIR OF THE WORK
- A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

SECTION 01 78 20  
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Emergency manuals.
  - 2. Operation manuals for systems, subsystems, and equipment.
  - 3. Maintenance manuals for the care and maintenance of products, materials, and finishes; systems and equipment.
- B. See Divisions 02 through 34 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 SUBMITTALS

- A. Manual: Submit one copy of each manual in final form at **mid-point of construction**. RPR will return copy with comments within 15 days.
  - 1. Correct or modify each manual to comply with RPR's comments and re-submit for approval. RPR will approve or return copy with additional comments within 15 days. Submit three (3) copies of each corrected and approved manual 15 days before the scheduled Substantial Completion and before demonstrations.
  - 2. Substantial Completion shall not occur until approved manuals are in the possession of the Owner and RPR.
  - 3. Any delays created by the Contractor in submittal approved manuals to the Owner and RPR may determine the impact of the schedule project delivery.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name, address, and telephone number of Contractor.
  - 6. Name and address of RPR.
  - 6. Name and address of Architect.
  - 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions

for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 'D' 3-ring, clear-vue, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine and cover to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
  - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project name, project number, subject matter of contents, and date of Substantial Completion. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
  - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
  - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

D. Digital Contents: Provide the required information above in PDF file format for the Owner's exclusive use.

## 2.2 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for type of emergency, emergency instructions, and emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component for fire, flood, gas leak, water leak, power failure, water outage, equipment failure and chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

## 2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.
- B. Descriptions: Include the following:
  1. Product name and model number.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.

7. Performance curves.
  8. Engineering data and tests.
  9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

## 2.4 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
  2. Manufacturer's name.
  3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

## 2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment.
- D. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions, and demonstration and training videotape if available, that detail essential maintenance procedures:
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

### PART 3 - EXECUTION

#### 3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
- F. Comply with Section 01 77 00 for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 017839  
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Record Samples.
  - 5. Record Schedule.
  - 6. Miscellaneous Record Submittals.
  - 7. Computer Aided Design and Drafting (CADD) requirements for Record Drawings.
- B. Related Requirements:
  - 1. Division 01 Section "Construction Progress Documentation" for construction schedules as basis for Record Schedule.
  - 2. Division 01 Section "Quality Requirements" for ensuring the record drawings and specifications are kept current on a daily basis and marked to show deviations which have been made from the original Contract documents
  - 3. Section 017300 "Execution" for final property survey.
  - 4. Section 017700 "Closeout Procedures" for general closeout procedures.
  - 5. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set(s) of marked-up record prints within 30 days of Final Completion.
- B. Record Specifications: Submit annotated PDF electronic files and two paper copies of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories and one paper copy of each submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as Record Product Data.
- D. Record Samples: Submit Record Samples as specified.
- E. Record Schedule: Submit three copies of Record Schedule.
- F. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit two electronic copies of all the archived documents in the software program be delivered to the RPR. The files shall contain the approved Submittals, RFIs and other record documents. SEE 1.8 below..
- G. Reports: Submit written report weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

#### 1.4 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
  1. Maintenance of Drawings: Maintain the drawings in a clean, dry, legible condition. Keep drawings available during normal working hours for inspection by the RPR.
  2. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross-reference record prints to corresponding photographic documentation.
  3. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or RFI.



- k. Changes made following RPR's written orders.
  - l. Details not on the original Contract Drawings.
  - m. Field records for variable and concealed conditions.
  - n. Record information on the Work that is shown only schematically.
- 4. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
- 5. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 6. Mark important additional information that was either shown schematically or omitted from original Drawings.
- 7. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

## 1.5 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  - 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
  - 5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
- B. Format: Submit record specifications as annotated PDF electronic file.

## 1.6 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

- C. Format: Submit Record Product Data as annotated PDF electronic file.
  - 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

#### 1.7 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
  - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

#### 1.8 Electronic Management Software

- A. All information managed and archived by the Electronic Management Software (Newforma, Procore, etc.) for submittals, RFIs, logs, meetings, etc. shall be downloaded from the provider site and two electronic copies provided to the RPR. The information shall be provided in an electronic format that is commonly used to retrieve and reproduce the information.

#### 1.9 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for RPR's and Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839p

SECTION 01 79 00  
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:  
**Note that final approved copies of Operation and Maintenance Manuals must be received by the Owner prior to any demonstrations or training.**
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
  - 3. Demonstration and training videotapes.
- B. See Divisions 02 through 34 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 SUBMITTALS

- A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
- B. Demonstration and Training Compact Disc: Submit two copies within seven days of end of each training module.

1.3 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site. Review methods and procedures related to demonstration and training.
- D. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by RPR.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required.

- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
  2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
  3. Emergencies: Include instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.
  4. Operations: Include startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.
  5. Adjustments: Include alignments and checking, noise, vibration, economy, and efficiency adjustments.
  6. Troubleshooting: Include diagnostic instructions and test and inspection procedures.
  7. Maintenance: Include inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.
  8. Repairs: Include diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

## PART 3 - EXECUTION

### 3.1 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
1. Owner will furnish an instructor to describe Owner's operational philosophy.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
1. Schedule training with Owner with at least seven days' advance notice.

3.2 DEMONSTRATION AND TRAINING VIDEOTAPES

- A. General: Engage a qualified commercial photographer to record demonstration and training compact disc. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Videotape Format: Provide high-definition CD.

END OF SECTION

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SECTION 02 01 00  
SUBSURFACE SOIL EXPLORATION

PART 1 GENERAL

1.1 RESPONSIBILITY

- A. The information and data furnished from subsurface soil investigation for HGR Terminal Expansion prepared by Hill-Carnes Engineering Associates, dated December 11, 2018 is furnished for the Contractor's information. It is to be expressly understood that the Owner, Architect, Engineer or Soils Engineer will not be responsible for any interpretation or conclusion drawn therefrom. The Contractor shall excavate to the grades, slopes, lines, and levels indicated irrespective of the materials encountered with no increase in the contract cost to the Owner.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

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# **HILLIS-CARNES**

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## **ENGINEERING ASSOCIATES**

Geotechnical Engineering Study  
HGR Terminal Expansion  
Hagerstown Regional Airport  
Hagerstown, Maryland  
HCEA Job No. H18093

Prepared for:

Mr. Mahesh Kukata, P.E.  
Airport Design Consultants, Inc.  
6031 University Boulevard, Suite 330  
Ellicott City, Maryland 21046

December 11, 2018

Mr. Mahesh Kukata, P.E.  
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www.hcea.com

Re: Geotechnical Engineering Study  
**HGR Terminal Expansion**  
**Hagerstown Regional Airport**  
Hagerstown, Maryland  
HCEA Project No. H18093

Dear Mr. Kukata:

Hillis-Carnes Engineering Associates, Inc. (HCEA) has completed the geotechnical engineering study for the above-referenced project site that is located in Hagerstown, Maryland.

The exploration consisted of drilling Standard Penetration Test (SPT) borings, performing soil laboratory testing and engineering analyses, and preparing this written report of findings and conclusions.

We recommend that construction monitoring services be performed by HCEA. This will help verify that the project design and construction are consistent with the assumptions made in the analyses and conclusions contained in this report.

Boring samples will be stored at our Hagerstown, Maryland office for a minimum period of 30 days from the date of this letter. Should you wish the samples to be stored for a longer period of time or to be delivered to you or another party, please advise us. Should you have any questions or require additional information about our report, please contact us.

Most sincerely,  
**HILLIS-CARNES ENGINEERING ASSOCIATES, INC.**



Cindy S. Shepeck  
Vice President  
Branch Manager



Michael P. Johnson, P.E.  
Assistant Vice President  
Principal Engineer



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**GEOTECHNICAL ENGINEERING STUDY**  
**HGR TERMINAL EXPANSION**  
**HAGERSTOWN, MARYLAND**  
**HCEA PROJECT NO. H18093**

**1.0 PURPOSE AND SCOPE**

The purpose of this study was to determine the subsurface conditions at the boring locations and to evaluate those conditions with respect to concept and design of a foundation system, floor slabs, and site work for the proposed construction.

The evaluations and recommendations presented in this report were developed from an analysis of project characteristics and an interpretation of the general subsurface conditions at the site, based on the boring information. The stratification lines indicated on the Records of Soil Exploration (boring logs) represent the approximate boundaries between soil types. In-situ, however, the transitions may be gradual. Such variations can best be evaluated during construction and, if necessary, any minor design changes can be made at that time.

An evaluation of the site with respect to potential construction problems and recommendations dealing with the earthwork, and monitoring and testing services during construction are also included. The construction monitoring and testing services are considered necessary to verify the subsurface conditions and to verify the soils-related construction phases are performed properly.

The Appendix contains a summary of the field and laboratory work on which this report is based.

**2.0 PROJECT CHARACTERISTICS**

The project site is located to the north of the existing passenger terminal at the Hagerstown Regional Airport, just off of Showalter Road in Hagerstown, Maryland. The project site consists of an approximate 5323 sq-foot addition and a new boarding bridge foundation. A Site Location Map is included in the Appendix of this report.

The majority of the site is currently improved with an existing terminal building and associated surface concrete/bituminous paving for the apron. The site is generally flat in the vicinity of the proposed expansion with some slight slope decrease from the building to the apron for surface water runoff control.

The site development is expected to be comprised of a new terminal waiting area containing a maximum of 5323 square feet of floor area in a single-story within the main building structure.

At the time of this report, preliminary structural loading information was provided by your office. According to the information provided, the building will have a continuous foundation bearing load of approximately 3000 lbs/ln-ft and the columns will have a maximum load of 30 kips. It is anticipated that the loading for boarding bridge will consist of approximately 75-kips. Settlements on the order of 1-inch total and 1/2-inch differential have been assumed to be tolerable by the structures.

Should any of the project characteristics, structural loading conditions, or required settlement criteria differ from those outlined above, then this office should be contacted for a re-evaluation of the site.

### 3.0 FIELD EXPLORATION

A total of three (3) Standard Penetration Test (SPT) soil borings was drilled at the site for the purpose of this study. Borings T-1, B-32 and B-35 were drilled within the vicinity of the proposed structure expansion for the pavement evaluation and within the proposed boarding bridge to depths ranging from 4.5 to 20.2 feet below existing site grades. Boring locations were selected by HCEA in collaboration with the client and were rough staked in the field by HCEA personnel while referencing existing landmarks. Elevations for the boring locations were interpolated from the available site plans. The approximate boring locations are shown on the Boring Location Plan (Figure 2) included in the Appendix.

The borings were advanced with hollow-stem augers and the subsurface soils were sampled at 2.5 ft and 5.0 ft intervals. Samples were taken by driving a 1-3/8 inch I.D. (2-inch O.D.) split-spoon sampler in accordance with ASTM D-1586 specifications. The sampler was first seated 6 inches to penetrate any loose cuttings and then was driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated as the "Penetration Resistance" or "N" value. The penetration resistance, when properly evaluated, is an index of the soil strength and compression characteristics, are found in the Records of Soil Exploration (boring logs) included in the Appendix.

Also, rock coring was performed at boring location T-1 and extended 12 feet below where the auger refusal was encountered within this boring location. Rock core exploration findings can found in the Appendix on the Record of Soil Exploration for Boring T-1.

Representative portions of each soil sample were placed in glass jars and transported to Hillis-Carnes' laboratory. In the laboratory, the samples were visually examined by the Geotechnical Engineer to verify the driller's field classifications.

The samples were visually classified in general accordance with the Unified Soil Classification System and the field classifications were revised where necessary. The Unified Soil Classification Symbols appear on the boring logs and the system nomenclature is briefly described in the Appendix.

#### 4.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered at the site are shown on the Records of Soil Exploration (boring logs). A brief description of the subsurface conditions and pertinent engineering characteristics of the soils are given below.

Strata divisions shown on the boring logs have been estimated based on examinations of the recovered boring samples. In the field, strata changes could occur gradually and/or at slightly different levels than indicated. Also, any groundwater conditions indicated on the boring logs are those observed during the period of the subsurface exploration. Fluctuations in groundwater levels could occur seasonally and might also be influenced by changes in grading, runoff and infiltration rates, and other influencing factors.

Generalized subsurface conditions based on the results of the borings are discussed in detail in the following report sections. For more specific information on soil and groundwater conditions, please refer to the individual boring logs in the Appendix.

##### 4.1 General Site Geology

The Geologic Map of Maryland (1968) shows that the project site is located in an area where the parent bedrock formation could include the limestones of the Rockdale Run Formation of the Beekmantown Group.

The Rockdale Run Formation typically consists of “upper one-third gray, mottled cherty dolomite and dolomitic limestone; lower two-thirds gray, cherty, argillaceous calcarenite and algal limestone; thickness at least 1,700 feet east of the Conococheague Creek, increases to the west to 2,500 feet.”

In-situ decomposition of limestone materials typically produces surficial layers of residual soil of significant variable thicknesses. Localized concentrations of bedding planes, fractures, or other discontinuities often result in decomposition extending to deeper levels in the subsurface profiles. Ridges and lenses of rock that is relatively resistant to decomposition form pinnacles of unweathered bedrock that can extend up to and nearly up to the ground surface. The localized deeper levels of decomposition and rock pinnacles all combine to form a highly irregular rock surface. Occasionally, solution cavities develop below or within the rock

surface. The cavities are sometimes left open or are filled with soft, reworked residual materials.

#### 4.2 Surficial Covering

In SPT borings, B-32 and B-35, a 5- to 18-inches thick pavement section was covering the area encompassing this portion of the site, overlying the 12-inches of stone subbase encountered in boring B-35 or natural materials within B-32. Within boring B-1, a topsoil layer of 3+/- inches was encountered overlaying the soil materials described in the following sections. However, topsoil/root mat thickness may vary across the site as it is currently a commercially landscaped area. As such, the boring logs should not be used solely to estimate topsoil and/or pavement removal quantities at the site.

#### 4.3 Man-Placed Fill Materials

Within T-1 boring location, a layer of fill materials was encountered just below the topsoil layer to approximately 2 feet below existing grade. The encountered materials consisted of clay, with various amounts of silt, rock fragments and organics.

Please note that test borings are not a definitive method of evaluating the presence and composition of existing fill materials because of the limited size of the hole diameters and the very limited sample sizes obtained in comparison to the areal extent of the site. Also, the fill materials may be similar in composition to the on-site natural soils and therefore would be difficult to distinguish in the relatively small boring samples obtained.

It should be anticipated that man-placed fill materials may be encountered at other locations and to different depths due to the previous uses at the site. For more specific information, refer to the Records of Soil Exploration in the Appendix.

#### 4.4 Natural Materials

The natural soils encountered immediately beneath the surficial and fill materials encountered consisted of predominantly low-plasticity clays (CL), including variable amounts of silts and rock fragments. The fine-grained materials encountered displayed consistencies ranging from medium stiff to stiff.

Refusal to augering and/or spoon refusal also occurred in T-1 at a depth of 8.1 feet below existing site grade. Refusal is a designation typically applied to material having a penetration resistance in excess of 50 blows per inch. Refusal may result from hard cemented soil, soft weathered rock, boulders, thin rock seams, or the upper surface of continuous rock. Rock coring was performed to determine the nature and competency of the refusal materials. The percent recovery in the boring ranged from 0 to 100 percent with RQD values ranging from 1 to 66 percent within the rock runs obtained within this sample location.

#### 4.5 Groundwater

Groundwater was monitored during drilling and at completion of drilling. Groundwater was not encountered within the depths explored in the borings at the time of our subsurface exploration.

A more accurate determination of the hydrostatic water table would require the installation of perforated pipes or piezometers that could be monitored over an extended period of time. The actual level of the hydrostatic water table and the amount and level of perched water should be anticipated to fluctuate throughout the year, depending on variations in precipitation, surface run-off, infiltration, site topography, and drainage.

### 5.0 EVALUATIONS AND RECOMMENDATIONS

Our findings indicate that the site can be developed for the proposed structures utilizing spread footing foundation support. The following recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions. If there are any changes to the project characteristics or if different subsurface conditions are encountered during construction, Hillis-Carnes should be consulted so that the recommendations of this report can be reviewed and revised, if necessary.

#### 5.1 General Site Preparation

Any existing below ground structures within the areas to be developed should be removed prior to the initiation of new construction. We suggest that all available information regarding the existing utilities at the site be reviewed prior to construction.

Removal should include all underground pipes, utilities, and underground structures that might interfere with the new construction. If abandoned underground utilities are to be removed prior to the initiation of construction, provisions should be made in the construction specifications and budget to



restore the subgrade to stable condition. Restoration should include backfilling and compaction of the excavation areas.

Removal should also include topsoil and unsuitable till materials; unapproved man-placed materials; frozen, wet, soft or very loose soils; and any other deleterious materials. These operations should be performed in a manner consistent with good erosion and sediment control practices.

Any additional evidence of sinkholes noted during construction may require additional field exploration (such as test pitting). These areas should be remediated in accordance with the recommendations in Section 5.2 of this report prior to the placement of new fill materials.

After the initial stripping process is completed, areas of the site to receive fill, or areas of the site at-grade where structures will be located, should be proofrolled. The proofrolling operations should be performed using a 20-ton, fully-loaded dump truck or another pneumatic-tire vehicle of similar size and weight. The purpose of the proofrolling will be to provide surficial densification and to locate any near-surface pockets of soft or loose soils requiring undercutting. A Geotechnical Engineer or experienced Soils Inspector should witness the proofrolling operations and determine whether any areas require undercutting and/or stabilization.

In areas where rock and auger refusal were encountered, more intensive excavation efforts will be required. In particular, areas of confined excavation may require blasting, ripping, jackhammering, or other rock excavation methods to establish proposed elevations. It should also be anticipated that boulders, hard spots or other localized areas of difficult excavation may be encountered.

It is recommended that an expert in blasting be consulted to evaluate the best methods to be used to protect all existing adjacent structures. It is recommended that the existing structures and vibrations be monitored throughout the blasting process. All exposed subgrades should be observed by HCEA to verify that all loose or otherwise unsuitable material is removed. Our representative should also look for any evidence of sinkholes that would need to be remediated prior to construction activities.

## 5.2 Sinkholes and Karst Topography

The greater Hagerstown area has what is referred to as a Karst Topography, and is underlain by a multifarious assortment of limestone substrata. The calcareous nature of this substrata and its variable weatherability lead to a somewhat irregular landscape. More resistant

materials form pinnacles of rock near or at the surface, while less resistant materials have parented deeper pockets of soil materials.

Fractures due to tectonic shifting have allowed access to, the dissolution of, and removal of more weatherable substrata materials beneath less weatherable ones. This removal can produce voids that may become unstable if the overburden becomes too great. At this point a failure will occur and collapse is probable. Historical collapses can be disguised over time by climatic forces. This fact makes subsurface exploration and evaluation imperative. It is also the reason subgrades are to be inspected prior to any construction operations involving the use of natural soils on Karst topography.

Although no expressed sinkholes were encountered during our exploration, any sinkholes encountered during construction should be remediated on a case-by-case basis. The geotechnical engineer should be contacted for site-specific recommendations when any sinkholes are observed.

To reduce the risk of sinkhole development, it is considered essential that adequate site drainage is provided at all times to minimize any increases in the moisture contents of the subsurface materials and to avoid aggravating incipient solution activity.

Site grades should be sloped to prevent the ponding of water adjacent to the proposed buildings or structures. Final designs should incorporate measures that will reduce water infiltration, including the following:

- Edge drains that flow directly to the storm drain system.
- Water tight storm drains.
- Swales adjacent to roadways should be lined with concrete, asphalt or soil/cement to prevent infiltration. Unlined swales are a very common cause of sinkhole development.

Utilities should be placed on well compacted firm soil to reduce possible settlement and leaks. Consideration should be given to hanging the utilities off of the floor slab to reduce the potential risk associated with both sinkhole development and potential settlements of the existing man-placed materials. Open graded stone should not be placed below the utility lines, as the stone easily transports water. Additionally, water lines should be periodically tested for leaks. Backfill around structures and

above utilities should be well compacted to reduce surface depressions which could collect water.

The client must acknowledge that there is always some risk associated with developing new structures in limestone (Karst) terrain, regardless of the extent of the exploration and/or design precautions. The possibility of sinkhole development can be reduced by taking the precautions included herein.

### 5.3 Fill Selection, Placement and Compaction

All material to be used as fill or backfill should be inspected, tested and approved by the Geotechnical Engineer. In general, the on-site soils which are free from organic and other deleterious components can be re-used as general site fill. Materials suitable for various construction purposes can be identified by an experienced Soils Inspector during grading operations.

Moisture conditioning (that is, wetting or drying) of the soils should be anticipated to achieve proper compaction, particularly if earthwork is performed other than in the summer months. The moisture contents of the soils should be controlled properly to avoid extensive construction delays. If imported fill material is required, those materials should have Unified Soil Classifications of SM or better.

All fill should be placed in relatively horizontal 8-inch (maximum) loose lifts and should be compacted to a minimum of 95 percent of the Modified Proctor (ASTM D-1557) maximum dry density. Fill materials in landscape and other non-structural areas should be compacted to at least 90 percent of the Modified Proctor maximum dry density if significant subsidence of the fill under its own weight is to be avoided. Field moisture contents should be maintained within 2 percentage points of the optimum moisture content in order to provide adequate compaction.

Structural fill should extend a minimum of ten feet beyond structural fill pads. Fill slopes no steeper than 2(H):1(V), or flatter, should be used. New fill materials should be properly benched into any existing slopes. A sufficient number of in-place density tests should be performed by an experienced Engineering Technician on a full-time basis to verify that the proper degree of compaction is being obtained.

### 5.4 Foundations

Our findings indicate that the proposed structures can be supported on shallow foundation system, such as spread footings, bearing on approved

natural soils, rock, newly placed engineered fill or a combination thereof. Footings should not be placed on or over any existing fill materials, should they be encountered, unless specifically approved by the Geotechnical Engineer.

Based on the general soil conditions that were encountered, it is our judgment that an allowable soil bearing pressure of 2500 lbs/sq ft can be used for foundations to be supported on approved natural soils, new structural fill placed over firm natural soils and rock. However, we recommend that rock, if encountered at the foundation bearing elevation, be removed at least 8 inches beneath proposed bottom of footing elevation and restored with properly compacted fill materials, such as sand to act as a buffer.

Based on information provided by your office, the column loads will be in the range of 30 kips and the continuous wall footing loads will be on the order of 3 kips per linear foot. Based on the subsurface conditions encountered in the soil borings and the anticipated structural loads, we expect footing settlements are not to exceed 1 inch. Differential settlements between similarly loaded footings are not expected to exceed 1/2 inch. However, if the loads differ from those provided, then this office should be contacted for further recommendations.

To preclude punching shear failures, wall footings should be at least 18 inches wide and column footings should be at least 24 inches wide. It is recommended that wall footings be provided with longitudinal reinforcement. Such reinforcement would provide the footings with greater bending capacity that should allow them to span across unsupported length of six feet to bridge any localized weak zones that may go undetected during construction.

All footing excavations should be inspected by a Geotechnical Engineer or experienced Soils Inspector prior to the placement of concrete. The purpose of the inspection would be to verify that the exposed materials will be capable of supporting the design bearing pressure. If soft or very loose pockets are encountered in the footing excavations, the unsuitable materials should be removed and the footings should be located at a lower elevation. Alternatively, the unsuitable materials could be undercut and replaced with either new fill placed and compacted in accordance with the recommendations of Sections 5.1 and 5.3 of this report or with lean (2000 psi) concrete.

In all areas where foundations will be supported on structural fill, the structural fill should extend a sufficient distance laterally beyond the

perimeters of footings. For design purposes, plans should reflect structural fill extending a minimum distance of 9 inches laterally beyond a footing perimeter for each linear ft of structural fill below the bearing level.

Exterior footings and footings in unheated areas should be located at depths of at least 2.5 ft below final exterior grades so as to provide adequate protection from frost heave. If the structures are to be constructed during the winter months or if the building interior will likely be subjected to freezing temperatures after footing construction, then all footings should be provided with adequate frost cover protection. Otherwise, interior footings can be located on suitable materials at nominal depths below finished floor grade.

#### 5.5 Ground-Supported Slabs

Floor slabs should be supported on approved firm natural soils, approved existing fill materials, or on new compacted fill. The slab subgrade should be prepared in accordance with the procedures outlined in Sections 5.1 and 5.3 of this report. In particular, the slab subgrade should be heavily proofrolled to delineate any soft or loose areas requiring undercutting and/or stabilization.

It is recommended that the slab be directly supported on a minimum 4-inch layer of clean granular materials such as washed sand, clean sand and gravel, or screened, crushed stone. These materials will require acquisition from an off-site source. A suitable moisture/vapor barrier (that is, polyethylene sheeting) should also be provided. These procedures will provide a moisture break that will help to prevent capillary rise, dampness of the floor slabs and also help to cure the slab concrete. It is also recommended that construction joints on the slab surface and isolation joints between the slab and structural walls be provided (such that the slab would be ground-supported).

On most projects, there is a significant time lag between initial grading and a point when the contractor is ready to pour the slabs-on-grade. Exposure to the elements and construction traffic often disturb the subgrade soils. Provisions should be made in the construction specifications for the restoration of the subgrade soils to a stable condition prior to the placement of the concrete for the floor slab.

#### 5.6 Groundwater and Drainage

As previously mentioned, groundwater was not encountered within the depths explored in any of the soil borings drilled within the site. However,

any water infiltration resulting from a shallow interception of the groundwater table, precipitation, surface run-off, or perched water should be able to be controlled by means of sump pits and pumps, or by gravity ditching procedures. If any conditions are encountered which cannot be handled in such a manner, this office should be consulted.

Adequate drainage should be provided at the site to minimize any increases in the moisture contents of the foundation soils. All pavement or parking areas should be sloped away from the structures to prevent the ponding of water. In pavement/parking lot areas, it may be necessary to locally provide finger drains where it is not possible to properly slope pavement subgrades to catch basins or other outlets.

#### 5.7 Site Seismicity

According to the 2012 International Building Code, Section 1613.3.2 (Chapter 20 of ASCE 7), seismic Site Class C should be specified for this project.

### 6.0 RECOMMENDED ADDITIONAL SERVICES

Additional soil and foundation engineering, testing, and consulting services recommended for this project are summarized below:

Site Preparation and Proofrolling: A Geotechnical Engineer or experienced Soils Inspector should inspect the site after it has been stripped and excavated. The inspector should determine if any undercutting or in-place densification is necessary to prepare pavement or building subgrades for fill placement or for slab support.

Fill Placement and Compaction: A Geotechnical Engineer or experienced Soils Inspector should witness any required filling operations and should take sufficient in-place density tests to verify that the specified degree of fill compaction is achieved. He should observe and approve borrow materials used and should determine if their existing moisture contents are suitable.

Footing Excavation Inspections: A Geotechnical Engineer or experienced Soils Inspector should inspect the footing excavations for the building. He should verify that the design bearing pressure is available and that no loose pockets exist beneath the bearing surfaces of the footing excavations. Based on the inspection, the Inspector would either approve the bearing surfaces or recommend that loose or soft soils be undercut to expose satisfactory bearing materials.

Test Pits and Additional Soil Exploration: A Geotechnical Engineer or experienced Soils Inspector should inspect subgrade soil materials excavated within portions of the site that have questionable suitability for their proposed use. Based on this additional exploration of subsurface conditions prior to construction, recommendations regarding the suitability of the site's subgrade can be made and precautionary recommendations regarding construction operations on the site can be given.

## 7.0 REMARKS

This report has been prepared to aid in the evaluation of the site for the proposed construction. It is considered that adequate recommendations have been provided to serve as a basis for design and preparation of plans and specifications. Additional recommendations can be provided as needed.

These analyses and recommendations are, of necessity, based on the information made available to us at the time of the actual writing of the report and the on-site surface and subsurface conditions that existed at the time the exploratory borings were drilled. Further assumption has been made that the limited exploratory borings, in relation both to the areal extent of the site and to depth, are representative of conditions across the site.

If subsurface conditions are encountered which differ from those reported herein, this office should be notified immediately so that the analyses and recommendations can be reviewed and/or revised as necessary. It is also recommended that:

1. We are given the opportunity to review any plans and specifications in order to comment on the interaction of the soil conditions as described herein and the design requirements.
2. The Geotechnical Engineer or his designated representative is present at the site during the construction phase to verify installation according to the approved plans and specifications. This is particularly important during excavation, placement, and compaction of fill materials.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties either implied or expressed. HCEA assumes no responsibility for interpretations made by others based on work or recommendations by us.

## APPENDIX

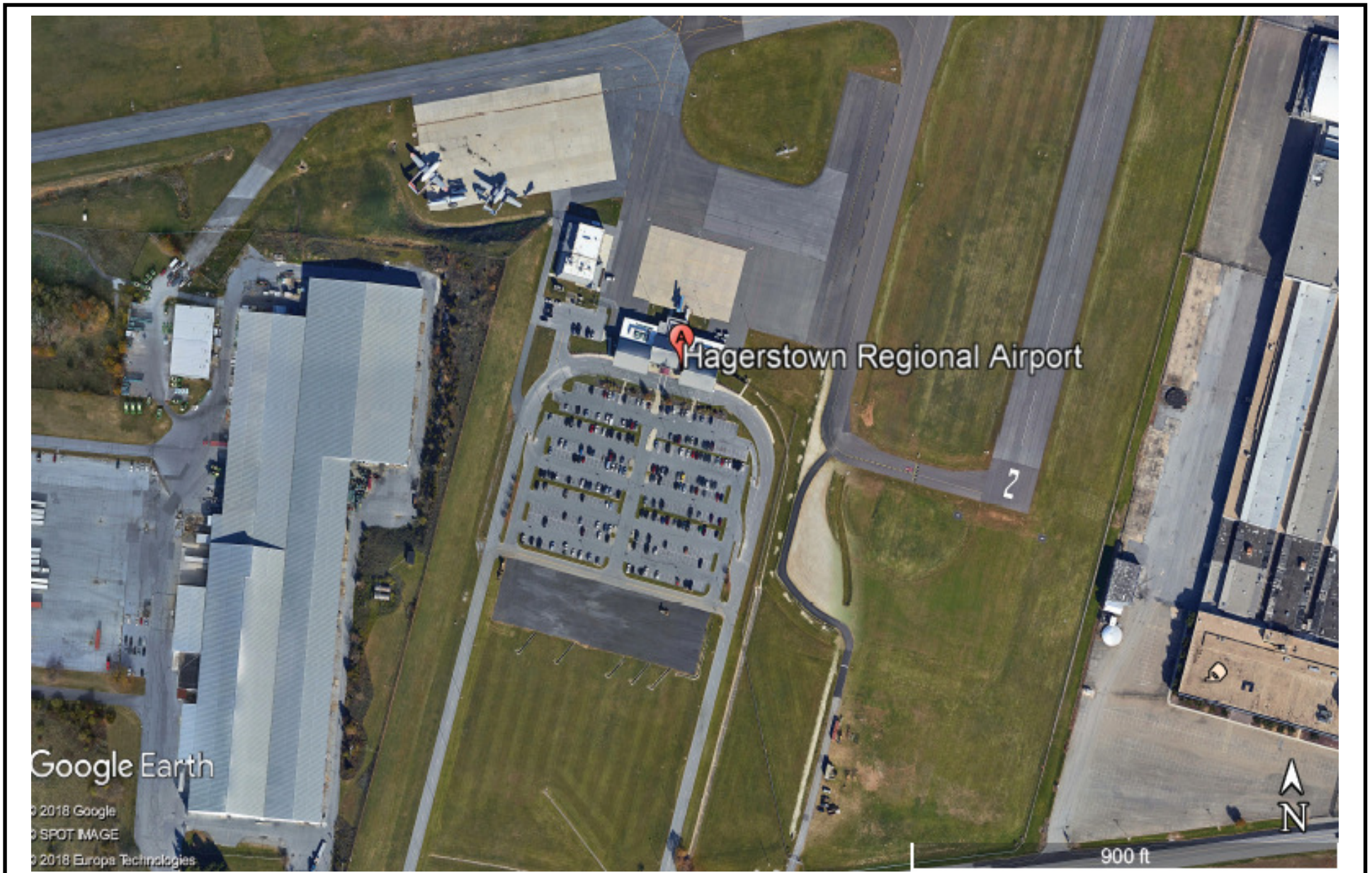
Figure 1: Site Location Plan

Figure 2: Boring Location Plan

Records of Soil Exploration (Test Boring Logs)

General Geotechnical Notes





**HILLIS-CARNES**

**ENGINEERING ASSOCIATES, INC.**

## Figure 1: Site Location Plan

HGR Terminal Expansion  
Hagerstown, MD  
HCEA Project No.: H18093

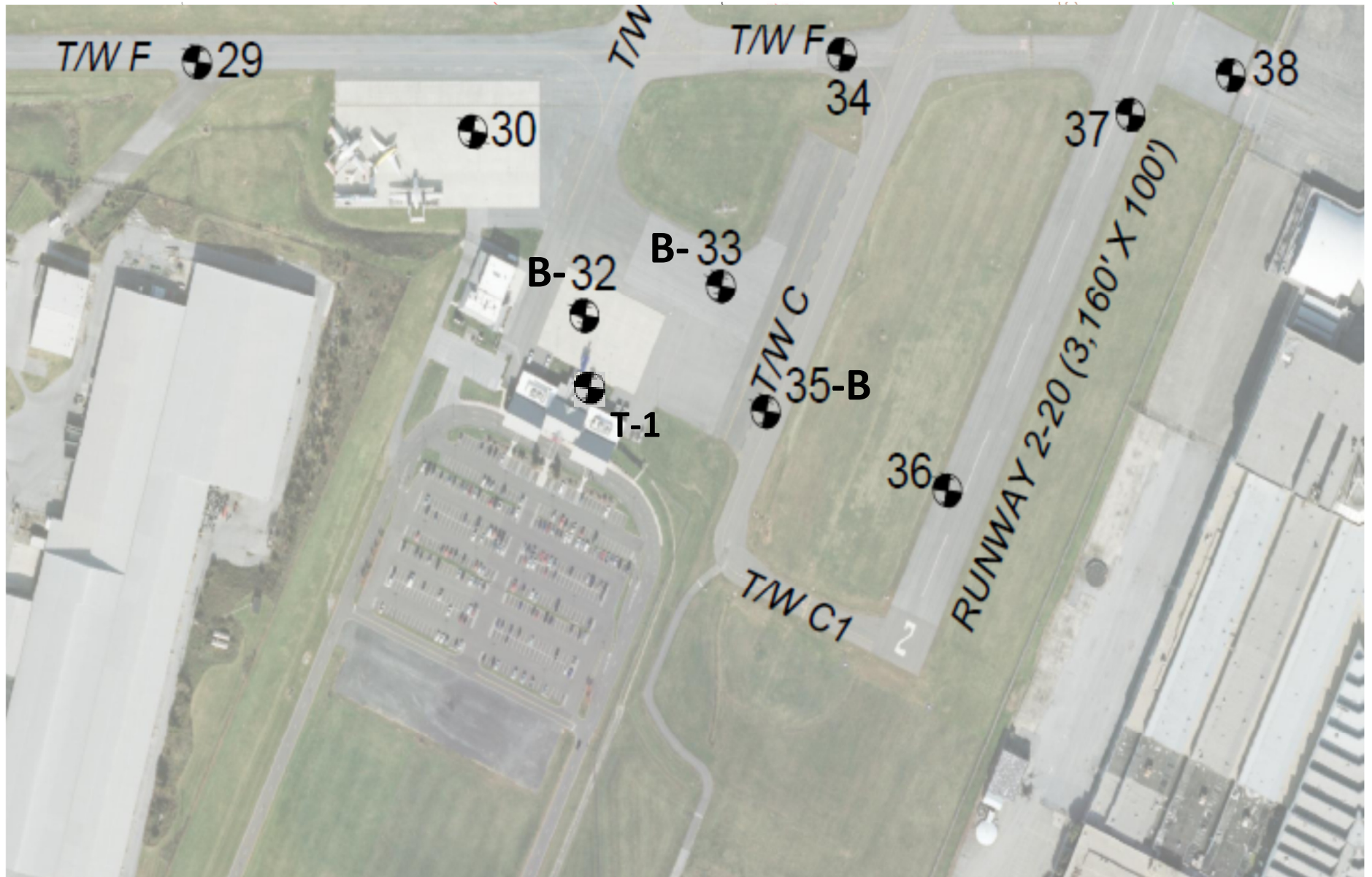
10228 Governor Lane Boulevard

Williamsport, Maryland

Local 301-582-4662

Fax 301-582-4614





**HILLIS-CARNES**

ENGINEERING ASSOCIATES, INC.

## Figure 2: Boring Location Plan

HGR Terminal Expansion  
Hagerstown, MD  
HCEA Project No.: H18093

10228 Governor Lane Boulevard

Williamsport, Maryland

Local 301-582-4662

Fax 301-582-4614

# HILLIS - CARNES ENGINEERING ASSOCIATES, INC.

## RECORD OF SOIL EXPLORATION

Project Name HGR Runway Evaluation Boring No. T-1  
 Location Hagerstown, Maryland Job # H18093

### SAMPLER

Datum MSL Hammer Wt. 140 lbs. lbs. Hole Diameter 2.25" Foreman C. Leatherman  
 Surf. Elev. \_\_\_\_\_ ft Hammer Drop 30" in Rock Core Diameter \_\_\_\_\_ Inspector C. Shepeck  
 Date Started 9/19/2018 Pipe Size 2.0 " OD in Boring Method HSA Date Completed 9/19/2018

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	No.	Rec.	SPT Blows	SPT Blows/Foot			NM	
							N	Curve			
								10	30	50	
0	D	Dark brown, moist, medium stiff silty CLAY, some rock fragementes and organics (OLD FILL MATERIALS)	Topsoil: 5"	1	12"	1-2-3-2	5				
	I	Brown, moist, stiff silty CLAY (CL)		2	16"	3-4-5-9	9				
4	I		Spoon deflected on a rock ledge for last 2 increments	3	20"	6-9-*-*	9+				
	I		Spoon deflected on a rock ledge for last increment	4	9"	2-2-12-*	14				
8	I	Limestone, highly fractured and weathered	Recovery: 1% RQD: 0%	5	1"						
	I	Limestone, fractured, slightly weathered.	Recovery: 49% RQD: 100%	6	60"						
12	I										
	I	Limestone, fractured, slightly weathered.	Recovery: 66% RQD: 100%	7	60"						
16	I										
20		Bottom of Hole at 20.2'									
24											

#### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

#### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

#### GROUND WATER

AT COMPLETION dry ft  
 AFTER 24 HRS. N/A ft  
 AFTER \_\_\_\_ HRS. \_\_\_\_\_ ft

#### CAVE IN DEPTH

6.0' ft  
N/A ft  
 \_\_\_\_\_ ft

#### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

# HILLIS - CARNES ENGINEERING ASSOCIATES, INC.

## RECORD OF SOIL EXPLORATION

Project Name HGR Runway Evaluation Boring No. B-32  
 Location Hagerstown, Maryland Job # H18093

### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. lbs. Hole Diameter 2.25" Foreman C. Leatherman  
 Surf. Elev. \_\_\_\_\_ ft Hammer Drop 30" in Rock Core Diameter \_\_\_\_\_ Inspector C. Shepeck  
 Date Started 8/29/2018 Pipe Size 2.0 " OD in Boring Method HSA Date Completed 8/29/2018

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	No.	Rec.	SPT Blows	SPT Blows/Foot			NM	
							N	Curve			
								10	30	50	
0		12" of Concrete									
		6" of Asphalt									
1.5				1	21"	3-4-4-8	8				
3		Orangish brown, moist, medium stiff to stiff, CLAY. (CL)	No groundwater encountered while drilling Backfilled at completion	2	24"	6-7-8-11	15				
4.5											
		Bottom of the hole at 5.5 feet.									
6											
7.5											
9											

#### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

#### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

AT COMPLETION  
 AFTER 24 HRS.  
 AFTER \_\_\_\_ HRS.

#### GROUND WATER

dry ft  
 \_\_\_\_\_ ft  
 \_\_\_\_\_ ft

#### CAVE IN DEPTH

2.5' ft  
 \_\_\_\_\_ ft  
 \_\_\_\_\_ ft

#### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

# HILLIS - CARNES ENGINEERING ASSOCIATES, INC.

## RECORD OF SOIL EXPLORATION

Project Name HGR Runway Evaluation Boring No. B-35  
 Location Hagerstown, Maryland Job # H18093

### SAMPLER

Datum \_\_\_\_\_ Hammer Wt. 140 lbs. lbs. Hole Diameter 2.25" Foreman C. Leatherman  
 Surf. Elev. \_\_\_\_\_ ft Hammer Drop 30" in Rock Core Diameter \_\_\_\_\_ Inspector C. Shepeck  
 Date Started 8/29/2018 Pipe Size 2.0 " OD in Boring Method HSA Date Completed 8/29/2018

Elevation/ Depth	SOIL SYMBOLS/ SAMPLE CONDITIONS	Description	Boring and Sampling Notes	No.	Rec.	SPT Blows	SPT Blows/Foot			NM	
							N	Curve			
								10	30	50	
0		5" of Asphalt									
		12" of Gravel									
1.5				1	19"	20-17-7-5	24				
3		Dark brown, moist, very stiff to medium stiff, silty CLAY, some limestone fragments. (CL/ML)	No groundwater encountered while drilling Backfilled at completion	2	24"	2-3-4-4	7				
4.5		Bottom of the hole at 4.5 feet.									
6											
7.5											
9											

#### SAMPLER TYPE

DRIVEN SPLIT SPOON UNLESS OTHERWISE  
 PT - PRESSED SHELBY TUBE  
 CA - CONTINUOUS FLIGHT AUGER  
 RC - ROCK CORE

#### SAMPLE CONDITIONS

D - DISINTEGRATED  
 I - INTACT  
 U - UNDISTURBED  
 L - LOST

AT COMPLETION  
 AFTER 24 HRS.  
 AFTER \_\_\_\_ HRS.

#### GROUND WATER

dry ft  
 \_\_\_\_\_ ft  
 \_\_\_\_\_ ft

#### CAVE IN DEPTH

2.0' ft  
 \_\_\_\_\_ ft  
 \_\_\_\_\_ ft

#### BORING METHOD

HSA - HOLLOW STEM AUGERS  
 CFA - CONTINUOUS FLIGHT AUGERS  
 DC - DRIVING CASING  
 MD - MUD DRILLING

# HILLIS-CARNES ENGINEERING ASSOCIATES, Inc.

10228 Governor Lane Blvd., Williamsport, Maryland 21795

Phone: (301)582-4662 • Fax: (301)582-4614

## Description of Soils – per ASTM D2487

Major Component	Component Type	Component Description	Symbol	Group Name
<b>Coarse-Grained Soils,</b> More than 50% is retained on the No. 200 sieve	<b>Gravels</b> – More than 50% of the coarse fraction is retained on the No. 4 sieve. Coarse = 1" to 3" Medium = ½" to 1" Fine = ¼" to ½"	Clean Gravels <5% Passing No. 200 sieve	<b>GW</b>	Well Graded Gravel
			<b>GP</b>	Poorly Graded Gravel
		Gravels with fines, >12% Passing the No. 200 sieve	<b>GM</b>	Silty Gravel
			<b>GC</b>	Clayey Gravel
	<b>Sands</b> – More than 50% of the coarse fraction passes the No. 4 sieve. Coarse = No.10 to No.4 Medium = No. 10 to No. 40 Fine = No. 40 to No. 200	Clean Sands <5% Passing No. 200 sieve	<b>SW</b>	Well Graded Sand
			<b>SP</b>	Poorly Graded Sand
		Sands with fines, >12% Passing the No. 200 sieve	<b>SM</b>	Silty Sand
			<b>SC</b>	Clayey Sand
<b>Fine Grained Soils,</b> More than 50% passes the No. 200 sieve	Silts and Clays Liquid Limit is less than 50 Low to medium plasticity	Inorganic	<b>ML</b>	Silt
			<b>CL</b>	Lean Clay
	Silts and Clays Liquid Limit of 50 or greater Medium to high plasticity	Organic	<b>OL</b>	Organic silt Organic Clay
		Inorganic	<b>MH</b>	Elastic Silt
			<b>CH</b>	Fat Clay
		Organic	<b>OH</b>	Organic Silt Organic Clay
<b>Highly Organic Soils</b>	Primarily Organic matter, dark color, organic odor		<b>PT</b>	Peat

## Proportions of Soil Components

Component Form	Description	Approximate percent by weight
Noun	Sand, Gravel, Silt, Clay, etc.	50% or more
Adjective	Sandy, silty, clayey, etc.	35% to 49%
Some	Some sand, some silt, etc.	12% to 34%
Trace	Trace sand, trace mica, etc.	1% to 11%
With	With sand, with mica, etc.	Presence only

## Particle Size Identification

Particle Size	Particle dimension
Boulder	12" diameter or more
Cobble	3" to 12" diameter
Gravel	¼" to 3" diameter
Sand	0.005" to ¼" diameter
Silt/Clay (fines)	Cannot see particle

## Cohesive Soils

Field Description	Consistency
Easily Molded in Hands	Very Soft
Easily penetrated several inches by thumb	Soft
Penetrated by thumb with moderate effort	Medium
Penetrated by thumb with great effort	Stiff
Indented by thumb only with great effort	Hard

## Granular Soils

No. of SPT Blows/ft	Relative Density
0 – 4	Very Loose
5 – 10	Loose
11 – 30	Medium Dense
31 – 50	Dense
Greater than 50	Very Dense

## Other Definitions:

- **Fill:** Encountered soils that were placed by man. Fill soils may be controlled (engineered structural fill) or uncontrolled fills that may contain rubble and/or debris.
- **Saprolite:** Soil material derived from the in-place chemical and physical weathering of the parent rock material. May contain relic structure. Also called residual soils. Occurs in Piedmont soils, found west of the fall line.
- **Disintegrated Rock:** Residual soil material with rock-like properties, very dense, N = 60 to 51/0".
- **Karst:** Descriptive term which denotes the potential for solutioning of the limestone rock and the development of sinkholes.
- **Alluvium:** Recently deposited soils placed by water action, typically stream or river floodplain soils.
- **Groundwater Level:** Depth within borehole where water is encountered either during drilling, or after a set period of time to allow groundwater conditions to reach equilibrium.
- **Caved Depth:** Depth at which borehole collapsed after removal of augers/casing. Indicative of loose soils and/or groundwater conditions.

SECTION 02 41 19  
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Demolition and removal of selected portions of building or structure.
  - 2. Demolition and removal of selected site elements.
  - 3. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
  - 1. Section 01 10 00 - Summary for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
  - 2. Section 31 10 00 - Site Clearing for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Natural rock excavated from the site is to be carefully salvaged and stored on-site per Section 12 93 00.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project site.
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review structural load limitations of existing structure.

3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
  1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's facility manager's on-site operations are uninterrupted.
  2. Interruption of utility services. Indicate how long utility services will be interrupted.
  3. Coordination for shutoff, capping, and continuation of utility services.
  4. Use of elevator and stairs.
  5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- E. Pre-demolition Photographs or Video: Submit before Work begins.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- G. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

#### 1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

#### 1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.



- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Historic Areas: It is not expected that historic areas or items will be encountered in the Work.
  - 1. If historical items, relics, antiques or similar items are encountered, immediately notify the architect and owner. Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.
- F. Storage or sale of removed items or materials on-site is not permitted.
- G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

#### 1.10 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs or preconstruction videotapes.
  - 1. Comply with requirements specified in Section 01 32 30.
  - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
  - 3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
  - 1. Comply with requirements for existing services/systems interruptions specified in Section 01 10 00.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. Arrange to shut off indicated utilities with utility companies.
  - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in Section 01 50 00.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.

### 3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated on demolition drawings. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
  - 5. Maintain adequate ventilation when using cutting torches.
  - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  - 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 9. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 50 50.

- B. Removed and Salvaged Items:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to Owner.
  - 4. Transport items to Owner's storage area designated by Owner.
  - 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
  - 1. Clean and repair items to functional condition adequate for intended reuse.
  - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  - 3. Protect items from damage during transport and storage.
  - 4. Sort and store items on-site.
  - 5. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Reinforced Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings"
- F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
  - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
  - 2. Remove existing roofing system down to substrate.
- G. Natural Stone Boulders: Remove, sort by size categories I-III on site for reuse on site in areas indicated on plan documents. Architect to flag boulders to be reused. Contractor to notify Architect 2 weeks in advance of moving the boulders confirmed for reuse. Contractor to provide 10% more boulders than indicated on documents for reuse and storage to allow for overage.

### 3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  4. Comply with requirements specified in Section 01 50 50.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.
- 3.7 CLEANING
- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

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SECTION 03 30 00  
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Footings.
  - 2. Foundation walls.
  - 3. Slabs-on-grade.
  - 4. Suspended slabs.
- B. Related Sections include the following:
  - 1. Section 31 20 00 - Earth Moving for drainage fill under slabs-on-grade.
  - 2. Section 32 13 13 -Concrete Paving for concrete pavement and walks.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
  - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- E. Samples (Information Only): For vapor retarder.
- F. Welding certificates (Information Only).
- G. Qualification Data (Information Only): For testing agency.
- H. Material Test Reports (Information Only): For the following, from a qualified testing agency, indicating compliance with requirements:
- I. Retain option in subparagraph below if retaining service record data with "Normal-Weight Aggregates" Paragraph in Part 2 "Concrete Materials" Article.

- J. Material Certificates (Information Only): For each of the following, signed by manufacturers:
    - 1. Cementitious materials.
    - 2. Admixtures.
    - 3. Form materials and form-release agents.
    - 4. Steel reinforcement and accessories.
    - 5. Fiber reinforcement.
    - 6. Curing compounds.
    - 7. Floor and slab treatments.
    - 8. Bonding agents.
    - 9. Adhesives.
    - 10. Vapor retarders.
    - 11. Semirigid joint filler.
    - 12. Joint-filler strips.
    - 13. Repair materials.
  - K. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
  - L. Field quality-control test and inspection reports.
  - M. Minutes of preinstallation conference.
- 1.4 QUALITY ASSURANCE
- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
  - B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
    - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
  - C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
    - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade I, according to ACI CP-01 or an equivalent certification program.
    - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
  - D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
  - E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
  - F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
    - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
    - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."



- G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete subcontractor.
  - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, vapor-retarder installation, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.
  - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. High-density overlay, Class 1 or better.
    - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    - c. Structural 1, B-B or better; mill oiled and edge sealed.
    - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
  - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.
- D. Plain-Steel Wire: ASTM A 82, as drawn.
- E. Deformed-Steel Wire: ASTM A 496.
- F. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- H. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from galvanized steel wire into flat sheets.

## 2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

- B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, ASTM A 775/A 775M epoxy coated.
- C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- D. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
  - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
  - 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

## 2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150, Type I.
    - a. Fly Ash: ASTM C 618, Class C.
    - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
  - 2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag cement.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Lightweight Aggregate: ASTM C 330, 1-inch nominal maximum aggregate size.
- E. Water: ASTM C 94/C 94M and potable.

## 2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
1. Available Products:
    - a. Boral Material Technologies, Inc.; Boral BCN.
    - b. Euclid Chemical Company (The); Eucon CIA.
    - c. Grace Construction Products, W. R. Grace & Co.; DCI.
    - d. Master Builders, Inc.; Rheocrete CNI.
    - e. Sika Corporation; Sika CNI.
- D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
1. Available Products:
    - a. Axim Concrete Technologies; Catexol 1000CI.
    - b. Boral Material Technologies, Inc.; Boral BCN2.
    - c. Cortec Corporation; MCI 2000.
    - d. Grace Construction Products, W. R. Grace & Co.; DCI-S.
    - e. Master Builders, Inc.; Rheocrete 222+.
    - f. Sika Corporation; FerroGard-901.

## 2.7 FIBER REINFORCEMENT

- A. Carbon-Steel Fiber: ASTM A 820, deformed, minimum of 1.5 inches long, and aspect ratio of 35 to 40.
1. Available Products:
    - a. Bekaert Corporation; Dramix.
    - b. Fibercon International, Inc.; Fibercon.
    - c. SI Concrete Systems; Zorex.
  2. Fiber: Type 1, cold-drawn wire.
- B. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.
1. Available Products:
    - a. Monofilament Fibers:
      - 1) Axim Concrete Technologies; Fibrasol IIP.
      - 2) Euclid Chemical Company (The); Fiberstrand 100.
      - 3) FORTA Corporation; Forta Mono.
      - 4) Grace Construction Products, W. R. Grace & Co.; Grace MicroFiber.
      - 5) Metalcrete Industries; Polystrand 1000.
      - 6) SI Concrete Systems; Fibermix Stealth.
    - b. Fibrillated Fibers:
      - 1) Axim Concrete Technologies; Fibrasol F.
      - 2) Euclid Chemical Company (The); Fiberstrand F.
      - 3) FORTA Corporation; Forta.
      - 4) Grace Construction Products, W. R. Grace & Co.; Grace Fibers.
      - 5) SI Concrete Systems; Fibermesh.

## 2.8 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
1. Available Products:
    - a. Fortifiber Corporation; Moistop Ultra A.
    - b. Raven Industries Inc.; Vapor Block 15.
    - c. Reef Industries, Inc.; Griffolyn Type-65G.

## 2.9 FLOOR AND SLAB TREATMENTS

- A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing 3/8-inch sieve.
1. Available Products:
    - a. Anti-Hydro International, Inc.; Emery.
    - b. Dayton Superior Corporation; Emery Non-Slip.
    - c. Emeri-Crete, Inc.; Emeri-Topcrete.
    - d. Lambert Corporation; EMAG-20.
    - e. L&M Construction Chemicals, Inc.; Grip It.
    - f. Metalcrete Industries; Metco Anti-Skid Aggregate.
- B. Emery Dry-Shake Floor Hardener: Pigmented, factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.
1. Color: As selected by Architect from manufacturer's full range.

## 2.10 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Available Products:
    - a. Axim Concrete Technologies; Cimfilm.
    - b. Burke by Edoco; BurkeFilm.
    - c. ChemMasters; Spray-Film.
    - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
    - e. Dayton Superior Corporation; Sure Film.
    - f. Euclid Chemical Company (The); Eucobar.
    - g. Kaufman Products, Inc.; Vapor Aid.
    - h. Lambert Corporation; Lambco Skin.
    - i. L&M Construction Chemicals, Inc.; E-Con.
    - j. MBT Protection and Repair, Div. of ChemRex; Confilm.
    - k. Meadows, W. R., Inc.; Sealtight Evapre.
    - l. Metalcrete Industries; Waterhold.
    - m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
    - n. Sika Corporation, Inc.; SikaFilm.
    - o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
    - p. Unitex; Pro-Film.
    - q. US Mix Products Company; US Spec Monofilm ER.
    - r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Available Products:
    - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
    - b. Burke by Edoco; Aqua Resin Cure.
    - c. ChemMasters; Safe-Cure Clear.

- d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
- e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
- f. Euclid Chemical Company (The); Kurez DR VOX.
- g. Kaufman Products, Inc.; Thinfilm 420.
- h. Lambert Corporation; Aqua Kure-Clear.
- i. L&M Construction Chemicals, Inc.; L&M Cure R.
- j. Meadows, W. R., Inc.; 1100 Clear.
- k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
- l. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
- m. Tamms Industries, Inc.; Horncure WB 30.
- n. Unitex; Hydro Cure 309.
- o. US Mix Products Company; US Spec Maxcure Resin Clear.
- p. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

## 2.11 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

## 2.12 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

## 2.13 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
  1. Fly Ash: 25 percent.
  2. Combined Fly Ash and Pozzolan: 25 percent.
  3. Ground Granulated Blast-Furnace Slag: 50 percent.
  4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
  5. Silica Fume: 10 percent.
  6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
  7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
  1. Use water-reducing admixture in concrete, as required, for placement and workability.
  2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
  4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

## 2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
  1. Minimum Compressive Strength: 3000 psi at 28 days.
  2. Maximum Water-Cementitious Materials Ratio: 0.45.
  3. Slump Limit: 4 inches, plus or minus 1 inch.
  4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
  5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
- B. Foundation Walls: Proportion normal-weight concrete mixture as follows:
  1. Minimum Compressive Strength: 3500 psi at 28 days.
  2. Maximum Water-Cementitious Materials Ratio: 0.45.

3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Minimum Cementitious Materials Content: 470 lb/cu. yd.
3. Slump Limit: 5 inches, plus or minus 1 inch.
4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
7. Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd.
8. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

D. Suspended Slabs: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.
2. Minimum Cementitious Materials Content: 470 lb/cu. yd.
3. Slump Limit: 5 inches, plus or minus 1 inch.
4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
7. Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd.
8. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

## 2.15 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.16 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.



## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
  - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
  - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3. Install dovetail anchor slots in concrete structures as indicated.

### 3.3 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
  1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

### 3.4 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
  1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair vapor retarders according to manufacturer's written instructions.
- C. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
  1. Place and compact a 1/2-inch- thick layer of fine-graded granular material over granular fill.

### 3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

### 3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
  2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
  3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
- 3.7 CONCRETE PLACEMENT
- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Maintain reinforcement in position on chairs during concrete placement.
  3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  4. Slope surfaces uniformly to drains where required.
  5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
- 3.8 FINISHING FLOORS AND SLABS
- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.
1. Apply scratch finish to surfaces indicated.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of

trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
    - b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
    - c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
    - d. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.
  3. Finish and measure surface so gap at any point between concrete surface and an unlevleled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- G. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:
1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer.
  2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
  3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.
- 3.9 MISCELLANEOUS CONCRETE ITEMS
- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

### 3.10 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
  - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### 3.11 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### 3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 2. After concrete has cured at least 14 days, correct high areas by grinding.
  - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a special inspector and to perform field tests and inspections and prepare test reports.
- B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
1. Steel reinforcement placement.
  2. Steel reinforcement welding.
  3. Headed bolts and studs.
  4. Verification of use of required design mixture.
  5. Concrete placement, including conveying and depositing.
  6. Curing procedures and maintenance of curing temperature.
  7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
  2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.



6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  7. Compression Test Specimens: ASTM C 31/C 31M.
    - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
  8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
  9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
  10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
  11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
  12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
  13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
  14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION

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SECTION 04 10 00  
MASONRY MORTAR AND GROUT

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes mortar and grout for masonry.
- B. Related Sections:
  - 1. Section 04 20 00 - Unit Masonry: Installation of mortar and grout.
  - 2. Section 08 11 00 - Steel Doors and Frames: Grouting steel door frames.

1.2 REFERENCES

- A. American Concrete Institute:
  - 1. ACI 530 - Building Code Requirements for Masonry Structures.
  - 2. ACI 530.1 - Specifications for Masonry Structures.
- B. ASTM International:
  - 1. ASTM C5 - Standard Specification for Quicklime for Structural Purposes.
  - 2. ASTM C91 - Standard Specification for Masonry Cement.
  - 3. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
  - 4. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
  - 5. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
  - 6. ASTM C150 - Standard Specification for Portland Cement.
  - 7. ASTM C199 - Standard Test Method for Pier Test for Refractory Mortars.
  - 8. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
  - 9. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
  - 10. ASTM C387 - Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
  - 11. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
  - 12. ASTM C476 - Standard Specification for Grout for Masonry.
  - 13. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
  - 14. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
  - 15. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
  - 16. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry.
  - 17. ASTM C1314 - Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry.
  - 18. ASTM C1329 - Standard Specification for Mortar Cement.
  - 19. ASTM C1357 - Standard Test Method for Evaluating Masonry Bond Strength.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal requirements.
- B. Samples: Submit two samples of mortar, illustrating mortar color and color range.
- C. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.
- D. Test Reports:
  - 1. Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270 and test and evaluation reports to ASTM C780 for aggregate ratio and water content, air content, consistency and compressive strength.

- 2. Submit reports on grout indicating conformance of grout to property requirements of ASTM C476 and test and evaluation reports to ASTM C1019.
- E. Manufacturer's Installation Instructions: Submit premix mortar manufacturer's installation instructions.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### 1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.
- C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

### PART 2 PRODUCTS

#### 2.1 MORTAR AND MASONRY GROUT

- A. Manufacturers:
  - 1. Essroc
  - 2. Riverton, Product Flamingo
  - 3. Laticrete
  - 4. Substitutions: Section 01 60 00 - Product Requirements.

#### 2.2 COMPONENTS

- A. Mortar Cement: ASTM C1329, Types S.
- B. Mortar Aggregate: ASTM C144, standard masonry type.
- C. Grout Aggregate: ASTM C404, fine.
- D. Water: Clean and potable.
- E. Mortar Color: Flamingo C-55 with C-144 Sand.

#### 2.3 MIXES

- A. Mortar Mixes:
  - 1. Mortar for Structural Masonry: ASTM C270, Type S using Proportion specification.
  - 2. Mortar for Non-Structural Masonry: ASTM C270, Type S using Proportion specification.
  - 3. Pointing Mortar: ASTM C270, Type N using Proportion specification.
- B. Mortar Mixing:
  - 1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
  - 2. Achieve uniformly damp sand immediately before mixing process.
  - 3. Add mortar color and admixtures to achieve uniformity of mix and coloration.

4. Re-temper only within two hours of mixing.
- C. Grout Mixes:
  1. Grout for Non-Structural Masonry: 2,000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476 Fine or Course grout.
  2. Grout for Structural Masonry: 2,000 psi strength at 28 days; 8-11 inches slump; mixed in accordance with ASTM C476 Fine or Course grout.
  3. Application:
    - a. Coarse Grout: For grouting spaces with minimum 4 inches dimension in every direction.
    - b. Fine Grout: For grouting other spaces.
- D. Epoxy Mortar: Equal to Latapoxy SP-100.
  1. Stainless pigment free colorfast epoxy grout.
- E. Grout Mixing:
  1. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.
  2. Add admixtures; mix uniformly.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.
- B. Request inspection of spaces to be grouted.

### 3.2 PREPARATION

- A. Apply bonding agent to existing concrete surfaces.

### 3.3 INSTALLATION

- A. Install mortar and grout in accordance with ACI 530.1 Specifications for Masonry Structures.
- B. Epoxy Mortar:
  1. Surface Preparation: Before starting to grout remove spaces and debris in grout joints. Remove dust and dirt using a damp sponge. Do not leave water standing in joints. Do not clean tiles with acid base cleaners. Substrate temperature must be between 16°C and 32°C.
    - a. NOTE: Temperature will effect working properties of LATAPOXY SP-100 Stainless Grout. Warm temperatures will speed curing and shorten working time. Cool temperatures will slow curing and require longer time to traffic. Store LATAPOXY SP-100 Stainless grout at 21°C for 24 hours prior to use.
  2. Mixing: Pour LATAPOXY SP-100 Stainless Grout Part A and Part B into a clean mixing pail and mix thoroughly by hand or with a slow speed mixer (<300 RPM) until liquids are completely blended. Add LATAPOXY SP-100 Stainless Grout Part C Filler Powder and mix until uniformly blended.
  3. Application: Immediately pout entire contents of pain onto a flat surface (Do Not Leave in Pail). Spread with a sharp, firm rubber grout float. Work the grout paste into the joints until completely filled. Use diagonal strokes to pack the joints. Insure that joint is filled and grout is not just sitting on top (i.e. “bridging the joint”).

4. Cleaning: Remove excess grout from the face of the tiles with the edge of the grout float. Hold the float at a 90° angle and pull it diagonally across the joints and tile to avoid pulling out the material. Clean using a white nylon pad and plenty of cool, clean water. For detailed application instructions and coverage information refer to Data Sheet 631.5.

### 3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Testing Frequency: One set of specified tests for every 5,000 sf of completed wall area.
- C. Testing of Mortar Mix: In accordance with ASTM C780 for aggregate ratio and water content, air content, consistency, and compressive strength.
- D. Testing of Grout Mix: In accordance with ASTM C1019 for compressive strength, and in accordance with ASTM C143/C143M for slump.
- E. Test flexural bond strength of mortar and masonry units to ASTM C1357; test in conjunction with masonry unit sections specified.
- F. Test compressive strength of mortar and masonry to ASTM C1314; test in accordance with masonry unit sections specified.

### 3.5 SCHEDULES

- A. Exterior Cavity Wall: Brick masonry with Type S mortar with Type N pointing mortar.
- B. Interior Masonry Walls: Type S mortar.

END OF SECTION

SECTION 04 20 00  
UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
  - 1. Concrete masonry units (CMUs).
  - 2. Face brick.
  - 3. Building (common) brick.
  - 4. Hollow brick.
  - 5. Mortar and grout.
  - 6. Reinforcing steel.
  - 7. Masonry joint reinforcement.
  - 8. Ties and anchors.
  - 9. Embedded flashing.
  - 10. Miscellaneous masonry accessories.
  - 11. Cavity-wall insulation.
- B. Related Sections include the following:
  - 1. Section 07 26 10 - Below Grade Vapor Retarders for dampproofing applied to cavity face of backup wythes of cavity walls.
  - 2. Section 07 65 10 - Flexible Flashing Stainless Steel for exposed sheet metal flashing.
  - 3. Section 07 90 00 - Joint Protection for sealing control and expansion joints in unit masonry.
- C. Products furnished, but not installed, under this Section include the following:
  - 1. Dovetail slots for masonry anchors, installed under 03 30 00 - Cast-in-Place Concrete.
  - 2. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 05 Section "Structural Steel Framing."
- D. Products installed, but not furnished, under this Section include the following:
  - 1. Steel lintels and shelf angles for unit masonry, furnished under Section 05 50 00 - Metal Fabrications.
  - 2. Manufactured reglets in masonry joints for metal flashing, furnished under Section 07 65 10 – Flexible Flashing Stainless Steel.

1.2 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths ( $f_m$ ) at 28 days.
- B. Determine net-area compressive strength ( $f_m$ ) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- C. Determine net-area compressive strength ( $f_m$ ) of masonry by testing masonry prisms according to ASTM C 1314.

## 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
  - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
  - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
  - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection: For the following:
  - 1. Decorative concrete masonry units, in the form of small-scale units.
  - 2. Face brick, in the form of straps of five or more bricks.
  - 3. Colored mortar.
  - 4. Weep holes/vents.
- D. Samples for Verification: For each type and color of the following:
  - 1. Exposed concrete masonry units.
  - 2. Face brick, in the form of straps of five or more bricks.
  - 3. Special brick shapes.
  - 4. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
  - 5. Weep holes/vents.
  - 6. Accessories embedded in masonry.
- E. List of Materials Used in Constructing Mockups (Information Only): List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
  - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- F. Qualification Data (Information Only): For testing agency.
- G. Material Certificates (Information Only): Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
  - 1. Masonry units.
    - a. Include material test reports substantiating compliance with requirements.
    - b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
    - c. For exposed brick, include material test report for efflorescence according to ASTM C 67.
    - d. For surface-coated brick, include material test report for durability of surface appearance after 50-cycles of freezing and thawing per ASTM C 67.
    - e. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
  - 2. Cementitious materials. Include brand, type, and name of manufacturer.
  - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  - 4. Grout mixes. Include description of type and proportions of ingredients.
  - 5. Reinforcing bars.
  - 6. Joint reinforcement.
  - 7. Anchors, ties, and metal accessories.



- H. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
  - 1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
  - 2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- I. Statement of Compressive Strength of Masonry (Information Only): For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- J. Cold-Weather Procedures (Information Only): Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
  - 1. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
  - 2. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
  - 3. Mortar Test (Property Specification): For each mix required, per ASTM C 780.
  - 4. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.
  - 5. Prism Test: For each type of construction required, per ASTM C 1314.
- E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
- F. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.
  - 1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 48 inches high by full thickness.
  - 2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
  - 3. Clean exposed faces of panels with masonry cleaner indicated.
  - 4. Protect approved sample panels from the elements with weather-resistant membrane.
  - 5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
    - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

- G. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of typical wall area as shown on Drawings.
  2. Build mockups for typical exterior and interior walls in sizes approximately 60 inches long by 60 inches high by full thickness, including face and backup wythes and accessories.
    - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
    - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
    - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
  3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
  4. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
  5. Protect accepted mockups from the elements with weather-resistant membrane.
  6. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
    - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
  7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. Preinstallation Conference: Conduct conference at Project.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

#### 1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  2. Protect sills, ledges, and projections from mortar droppings.
  3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
  1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### 2.2 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

### 2.3 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:
  1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  2. Provide bullnose units for outside corners, unless otherwise indicated.

- B. Concrete Masonry Units: ASTM C 90.
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3050 psi.
  - 2. Weight Classification: Normal weight.
  - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
  - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
  - 5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.
- C. Concrete Building Brick: ASTM C 55.
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3500 psi.
  - 2. Weight Classification: Normal weight.
  - 3. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

## 2.4 CONCRETE LINTELS

- A. General: Provide either concrete lintels, at Contractor's option, complying with requirements below.
- B. Concrete Lintels: Precast units made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated. Cure precast lintels by same method used for concrete masonry units.
- C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-Place Concrete."

## 2.5 BRICK

- A. General: Provide shapes indicated and as follows:
  - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
  - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
  - 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
  - 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: ASTM C 216, Grade SW, Type FBX.
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 20,000 psi.
  - 2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
  - 3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
  - 4. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet .
  - 5. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
  - 6. Application: Use where brick is exposed, unless otherwise indicated.
  - 7. Provide face brick matching color range, texture, and size of existing adjacent brickwork.
    - a. Provide brick as manufactured by Sioux City Brick Co.; Color-Ebonite Satin; Type FBX; Size-Standard Modular, as supplied by Steffey & Findlay, Inc. 301-733-1600
  - 8. Color and Texture: Specified to match terminal building.

9. Available Products:
  - a. Provide brick as manufactured by Sioux City Brick Co.; Color-Ebonite Satin; Type FBX; Size-Standard Modular, as supplied by Steffey & Findlay, Inc. 301-733-1600.

## 2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- D. Masonry Cement: ASTM C 91.
  1. Available Products:
    - a. Capital Materials Corporation; Flamingo Color Masonry Cement.
    - b. Essroc, Italcementi Group; Brixment.
    - c. Holcim (US) Inc.; Mortamix Masonry Cement.
    - d. Lafarge North America Inc.; Lafarge Masonry Cement.
    - e. Lehigh Cement Company; Lehigh Masonry Cement.
    - f. National Cement Company, Inc.; Coosa Masonry Cement.
- E. Colored Cement Product: Packaged blend made from portland cement and lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
  1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
  2. Pigments shall not exceed 10 percent of portland cement by weight.
  3. Pigments shall not exceed 5 percent of masonry cement by weight.
  4. Products:
    - a. Colored Portland Cement-Lime Mix:
      - 1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
      - 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
      - 3) Lafarge North America Inc.; Eaglebond.
      - 4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
    - b. Color:
      - 1) Flamingo C-55 with C- 144 Sand.
- F. Aggregate for Mortar: ASTM C 144.
  1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
  3. White-Mortar Aggregates: Natural white sand or crushed white stone.
  4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C 404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
  1. Products:
    - a. Addiment Incorporated; Mortar Kick.
    - b. Euclid Chemical Company (The); Accelguard 80.

- c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
- d. Sonneborn, Div. of ChemRex; Trimix-NCA.

I. Water: Potable.

## 2.7 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951.
  - 1. Interior Walls: Hot-dip galvanized, carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
  - 3. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
  - 4. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
  - 5. Wire Size for Veneer Ties: W1.7 or 0.148-inch diameter.
  - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
  - 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- D. Masonry Joint Reinforcement for Multiwythe Masonry:
  - 1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches in width, plus 1 side rod at each wythe of masonry 4 inches or less in width.
  - 2. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
  - 3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.
- E. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.188-inch- diameter, hot-dip galvanized, carbon-steel continuous wire.

## 2.8 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.
  - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.
  - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
  - 3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
  - 4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
  - 5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
  - 6. Stainless-Steel Sheet: ASTM A 666, Type 304.
  - 7. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - 8. Stainless Steel bars: ASTM A 276 or ASTM a 666, Type 304.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
  - 1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
  - 2. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
  - 3. Wire: Fabricate from 3/16-inch-diameter, hot-dip galvanized steelwire.
- D. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
  - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire
  - 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.188-inch-diameter, hot-dip galvanized steel wire.
  - 3. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.053-inch- thick, steel sheet, galvanized after fabrication.
  - 4. Tie Section for Concrete: Corrugated metal ties with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch of masonry face.
- E. Partition Top anchors: 0.097-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins, unless otherwise indicated.
  - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M Epoxy coating 0.020 inch thick.
- G. Adjustable Masonry-Veneer Anchors
  - 1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
    - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
  - 2. Adjustable High-Strength Systems: Truss type with super-heavy duty eyelets and adjustable tab welded to side pods of 9 gauge or 3/16" wire. Adjustable wall ties are 3/16" diameter wire.

## 2.9 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
- B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.
- C. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- D. Postinstalled Anchors: Provide torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
  - 1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).

2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

## 2.10 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with Division 07 Section "Sheet Metal Flashing and Trim" and as follows:
1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
  2. Copper: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet, 10-oz./sq. ft. weight or 0.0135 inch thick for fully concealed flashing; 16-oz./sq. ft. weight or 0.0216 inch thick elsewhere.
  3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
  4. Fabricate through-wall metal flashing embedded in masonry from copper, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
    - a. Products:
      - 1) Cheney Flashing Company; Cheney Flashing.
      - 2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.
  5. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
  6. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
  7. Fabricate through-wall flashing with sealant stop where indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 3/8 inch to form a stop for retaining sealant backer rod.
  8. Fabricate metal drip edges for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
  9. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
  10. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 3/8 inch to form a stop for retaining sealant backer rod.
  11. Metal Expansion-Joint Strips: Fabricate from copper to shapes indicated.
- B. Flexible Flashing: For flashing not exposed to the exterior, use the following, unless otherwise indicated:
1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
    - a. Products:
      - 1) Advanced Building Products Inc.; Copper Fabric Flashing.
      - 2) AFCO Products Inc.; Copper Fabric.
      - 3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
      - 4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
      - 5) Polytite Manufacturing Corp.; Copper Fabric Flashing.
      - 6) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
      - 7) York Manufacturing, Inc.; York Copper Fabric Flashing.
- C. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.



1. Product: Subject to compliance with requirements, provide "Blok-Flash" by Advanced Building Products Inc.
  - D. Solder and Sealants for Sheet Metal Flashings:
    1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
    2. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
    3. Elastomeric Sealant: ASTM C 920, chemically curing urethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
  - E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- 2.11 MISCELLANEOUS MASONRY ACCESSORIES
- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
  - B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
  - C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
  - D. Weep/Vent Products: Use the following, unless otherwise indicated:
    1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
      - a. Products:
        - 1) Advanced Building Products Inc.; Mortar Maze weep vent.
        - 2) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
        - 3) Heckmann Building Products Inc.; No. 85 Cell Vent.
        - 4) Hohmann & Barnard, Inc.; Quadro-Vent.
        - 5) Wire-Bond; Cell Vent.
  - E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
    1. Provide one of the following configurations:
      - a. Strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.
      - b. Strips, not less than 3/4 inch thick and 10 inches wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
      - c. Sheets or strips full depth of cavity and installed to full height of cavity.
      - d. Sheets or strips not less than 3/4 inch thick and installed to full height of cavity with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from being clogged with mortar.
    2. Products:
      - a. Advanced Building Products Inc.; Mortar Break II.
      - b. Archovations, Inc.; CavClear Masonry Mat.
      - c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
      - d. Mortar Net USA, Ltd.; Mortar Net.

- F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
1. Products:
    - a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
    - b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
    - c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
    - d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

## 2.12 CAVITY-WALL INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C 1289, Type I (aluminum-foil-faced), Class 2 (glass-fiber-reinforced).
- B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

## 2.13 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
1. Manufacturers:
    - a. Diedrich Technologies, Inc.
    - b. EaCo Chem, Inc.
    - c. ProSoCo, Inc.

## 2.14 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
  2. Limit cementitious materials in mortar to portland cement and lime.
  3. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement and lime.
  4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For masonry below grade or in contact with earth, use Type S.
  2. For reinforced masonry, use Type S.
  3. For mortar parge coats, use Type S.
  4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.
  5. For interior non-load-bearing partitions, Type S.

- D. Pigmented Mortar: Use colored cement product
  - 1. Pigments shall not exceed 10 percent of portland cement by weight.
  - 2. Pigments shall not exceed 5 percent of masonry cement by weight.
  - 3. Mix to match Architect's sample.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
  - 1. Mix to match Architect's sample.
- F. Grout for Unit Masonry: Comply with ASTM C 476.
  - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
  - 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

## 2.15 SOURCE QUALITY CONTROL

- A. Engage a qualified independent testing agency to perform source quality-control testing indicated below:
  - 1. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- B. Clay Masonry Unit Test: For each type of unit furnished, per ASTM C 67.
- C. Concrete Masonry Unit Test: For each type of unit furnished, per ASTM C 140.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
  - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
  - 2. Verify that foundations are within tolerances specified.
  - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
  - 1. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
- H. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
  - 1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
  - 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
  - 3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
  - 4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
  - 5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
  - 6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
  - 7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

### 3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

- F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
  - 1. Install compressible filler in joint between top of partition and underside of structure above.
  - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.
  - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
  - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

### 3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and concrete masonry units as follows:
  - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
  - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
  - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
  - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
  - 1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

### 3.5 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together using one of the following methods:
  - 1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
    - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
  - 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
    - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.

- b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
- B. Bond wythes of composite masonry together using bonding system indicated on Drawings.
- C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
- D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.
  - 1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.
- E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
  - 1. Provide individual metal ties not more than 16 inches o.c.
  - 2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
  - 3. Provide rigid metal anchors not more than 24 inches o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

### 3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
  - 1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
    - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
    - b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.
  - 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
    - a. Where bed joints of both wythes align, tab-type reinforcement.
    - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement.
    - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement to allow for differential movement regardless of whether bed joints align.
  - 3. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Coat cavity face of backup wythe to comply with Section 07 26 10.
- E. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
  - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

### 3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
  - 1. Space reinforcement not more than 16 inches o.c.
  - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
  - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
    - a. Reinforcement above is in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

### 3.8 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
  - 1. Provide an open space not less than 1/2 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
  - 2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
  - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

### 3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
  - 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
  - 2. Install preformed control-joint gaskets designed to fit standard sash block.
  - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
  - 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick made from clay or shale as follows:
  - 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
  - 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
  - 3. Build in compressible joint fillers where indicated.
  - 4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
  - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 LINTELS

- A. Install steel lintels where indicated.
- B. Provide concrete lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows, unless otherwise indicated:
  - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
  - 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 4 inches, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
  - 3. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 4 inches, and 1-1/2 inches into the inner wythe.
  - 4. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
  - 5. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
  - 6. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
  - 7. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
  - 8. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
  - 9. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
  - 10. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of



wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- E. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
  - 1. Use specified weep/vent products to form weep holes.
- F. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches, to maintain drainage.
  - 1. Fill cavities full height by placing pea gravel in cavities as masonry is laid so that at any point masonry does not extend more than 24 inches above top of pea gravel.
- G. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.
- H. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
  - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

### 3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches.

### 3.13 FIELD QUALITY CONTROL

- A. Inspectors: Engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
  - 1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
- B. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
  - 1. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

- D. Clay Masonry Unit Test: For each type of unit provided, per ASTM C 67.
- E. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.
- F. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for compressive strength.
- G. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.
- H. Prism Test: For each type of construction provided, per ASTM C 1314 28 days.

### 3.14 PARGING

- A. Parge all cavity walls according to manufacturer's instructions.

### 3.15 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
  - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
  - 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

### 3.16 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 12 00  
STRUCTURAL STEEL FRAMING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Structural steel.
  - 2. Grout.
- B. Related Sections:
  - 1. Section 01 40 00 - Quality Requirements for independent testing agency procedures and administrative requirements.
  - 2. Section 03 30 00 – Cast-In-Place Concrete for epoxy and adhesive anchor attachments.
  - 3. Section 05 31 00 - Steel Decking for field installation of shear connectors through deck.
  - 4. Section 05 50 00 - Metal Fabrications for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
  - 5. Section 09 90 00 - Painting for surface-preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Heavy Sections: Rolled and built-up sections as follows:
  - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
  - 2. Welded built-up members with plates thicker than 2 inches. Column base plates thicker than 2 inches.

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer in the state of the Project, to withstand loads indicated and comply with other information and restrictions indicated.
  - 1. Select and complete connections using typical details indicated and AISC's "Manual of Steel Construction, 13<sup>th</sup> Edition".
  - 2. Use LRFD; data are given at factored-load level.
- B. Moment Connections: Type FR, fully restrained.
- C. Lateral Force Resisting System Construction: See Contract Drawings.

## 1.5 ACTION SUBMITTALS

### A. General:

1. Submittals and shop drawings shall not be made by using reproductions of Contract Drawings.
2. Submittals and shop drawings shall be submitted through General Contractor to Architect. Any fabrication of material before approval of drawings will be at the risk of Contractor.
  - a. Fabricated material and connections shall fit within architectural constraints.
  - b. Fabricator alone shall be responsible for errors of detailing and fabrication.
3. Contractor shall provide a proposed submittal schedule showing anticipated steel shop drawing submission dates a minimum of two (2) weeks prior to the first steel shop drawing submittal.
4. Steel submissions shall be submitted such that each individual construction sequence is a separate standalone submittal package with an Erection Plan, Assembly Drawings, and Piece Mark Drawings. Typical Details, Connections, Calculations and Sections may be submitted as one submittal package at Contractors option but must be received prior to the first sequence submission. Sequence submittals shall be submitted in the order that they will be Fabricated and Erected. Processing time for review of each sequence shall be allowed and shall not be assumed to be concurrent.
5. Sequences larger than the floor area of the largest single floor of the building will require additional review and processing time. Additional review and processing time shall not be assumed to be concurrent. Any sequence anticipated to be larger than the maximum single floor area shall be clearly indicated in the submittal schedule and brought to the Architect's/Engineer's attention for discussion of review times prior to submission of said sequence.

### B. Product Data: For each type of product indicated.

### C. Delegated-Design Submittal for Connections: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Submit in advance of steel shop drawings. All connections shall be designed by the fabricator's engineer per AISC 303 section 3.1.2 Option 3.

1. Proposed variations in typical details shown on drawings will be considered and such variations must have preliminary approval prior to preparation of detailed shop drawings.
2. Connection drawings and details shall be prepared under supervision and sealed by a professional Engineer Registered in State of the project. Fabricator shall submit certification by professional Engineer that connection design is in accordance with applicable codes and specifications.
3. Fabricator's engineer shall submit complete design calculations for each connection. Such calculations shall show details of assembled joint with bolts and welds required. Where predesigned connections are taken directly from tables in AISC Manual, calculations need not be submitted provided job design conditions precisely match those assumed in tables, data taken from tables is clearly identified with table number, and such connections are so indicated in calculations submitted. Design calculations shall be sealed by fabricator's registered professional engineer. Shop drawings submitted without complete design calculations will not be approved.

- D. Shop Drawings: Show fabrication of structural-steel components. Submit in advance of fabrication complete shop drawings prepared under the supervision of fabricator's registered professional Engineer for fabrication of each component part of structural steel framing.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include member size, length, and camber.
  - 3. Include embedment Drawings.
  - 4. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  - 5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
  - 6. Include material specifications.
  - 7. Indicate piece marks for field assembly.
- E. Erection Drawings: Submit erection drawings ("E" Sheets) as part of shop drawings, showing complete information necessary for erection of each component part of structural steel framing.
  - 1. Indicate setting drawings, templates and directions for installation of anchor rods and other anchorage devices embedded in concrete or masonry work.
  - 2. Indicate dimensions for alignment and elevation of each member.
  - 3. Indicate location of members and attachments by match-marking of piece members.
  - 4. Indicate piece marks for field assembly.
  - 5. Include type and location of each field connection, including splices.
  - 6. Indicate required number and location of shear connectors on each member.
  - 7. Indicate details of each field connection or typical connection.
  - 8. Indicate size, length and type of bolts required in each field connection.
- F. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
  - 1. Power source (constant current or constant voltage).
  - 2. Electrode manufacturer and trade name, for demand critical welds.
- G. Certificate of Conformance: Submit manufacturer's certificate of conformance and/or supporting Charpy V-Notch test reports for complete-joint-penetration weld filler metal where steel backer bars for CJP groove welded T and corner joints are elected by the Contractor to remain in place. Certificate of Conformance or test reports shall show filler metal has a specified Charpy V-Notch toughness of 20 ft-lbs at 40 degrees F.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer, fabricator, professional engineer, and testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
  - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.

2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Non-shrink grout.

F. Source quality-control reports.

#### 1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
  1. AISC 303 - "Code of Standard Practice for Steel Buildings and Bridges,"
  2. AISC 360 - "Specification for Structural Steel Buildings" dated March 9, 2005.
  3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Preinstallation Conference: Conduct conference at Project site.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the site at such intervals to ensure uninterrupted progress of work.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- C. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

#### 1.9 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

## PART 2 - PRODUCTS

### 2.1 STRUCTURAL-STEEL MATERIALS

- A. General: All structural steel materials to be domestically manufactured in the United States of America.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- C. See General Notes for Structural Steel ASTM designations and grades, u.n.o.
- D. Welding Electrodes: Comply with AWS requirements.

### 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. General:
  - 1. Bolts, connectors, and anchors shall be new and not be reused.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- D. Headed Anchor Rods: See general notes for grades. Headed anchor rods shall be straight.
  - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 4. Finish: Plain.
- E. Threaded Rods: See general notes for grades.
  - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 3. Finish: Plain.
- F. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- G. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- H. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

### 2.3 PRIMER

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- B. Primer: Comply with Section 09 90 00.
- C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- D. Galvanizing Repair Paint: ASTM A 780.

## 2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, ready-to- use nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. Grout shall have no drying shrinkage at any age.
  - 1. Non-metallic grout shall be used in all conditions unless noted otherwise.
  - 2. Compressive strength at 7 days: 6000 psi minimum.
  - 3. Compressive strength at 28 days: 8000 psi minimum.

## 2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
  - 1. Camber structural-steel members where indicated.
  - 2. Fabricate beams with rolling camber up.
  - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
  - 4. Mark and match-mark materials for field assembly.
  - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, punch, or mechanically thermally cut standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
- H. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches (250 mm) o.c. unless otherwise indicated.



- I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

## 2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
  - 2. Surfaces to be field welded.
  - 3. Surfaces to be high-strength bolted with slip-critical connections.
  - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. SSPC-SP 2, "Hand Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

## 2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
  - 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls, u.n.o.
3. Galvanize all steel exposed to weather, u.n.o.

## 2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
  1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
  1. Liquid Penetrant Inspection: ASTM E 165.
  2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  3. Ultrasonic Inspection: ASTM E 164.
  4. Radiographic Inspection: ASTM E 94.
- E. Full Penetration Welded Connections: In addition to visual inspection, complete joint penetration groove welds shall be ultrasonically tested for the entire weld length, in each designated joint per AWS D1.1 to the following extents:
  1. 100 percent of welds splicing beams, girders, columns, or braces.
  2. 100 percent of column to base plate welds at rigid (lateral) column frame bases.
  3. 100 percent of CJP beam to column welds, continuity plate welds, and shear tabs.
- F. Non-Destructive Testing of Welds:
  1. Ultrasonic Testing (UT): ASTM E164
    - a. Divide connections into groups containing not less than 40 connections. Test 25 percent of the connections in each group. If any weld is rejected, test all the connections in group.
- G. In addition to visual inspection, perform magnetic particle testing for full length of fillet welds on continuity plates and backing bar removal areas, and 25% of remaining fillet welds.
- H. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
  1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
  2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
  1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.
- B. Templates shall be provided and be securely in place to preclude misplacements of anchor rods. Rods shall be installed at locations and with projections established by approved structural steel shop drawings. Subsequent displacement of anchor rods is the responsibility of the General Contractor.

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  1. Set base and bearing plates for structural members level and to proper alignment with shim packs unless noted otherwise on the Contract Documents. Fabricator shall provide shim packs.
  2. Weld plate washers to top of baseplate.
  3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  1. Level and plumb individual members of structure.
  2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.

- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth. Backing bars MUST be removed if the project is in Seismic Design Category C and D. Contractor may elect to leave backing bars in place for all other projects if all following requirements are met:
    - a. Manufacturer shall submit a Certificate of Conformance and supporting Charpy V-Notch test reports showing filler metal used for backing bars has a toughness of 20 ft-lbs at 40 degrees F.
    - b. Certificate shall be received by the Engineer prior to the start of steel erection.
  - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field quality control and testing, including special inspections required by local building codes and the International Building Codes.
- B. General Field Inspection:
  - 1. Verify location and setting of anchor rods by witness of Contractor's final check prior to setting of steel members.
  - 2. Verify plumbness of columns is within allowable tolerance per AISC Code and Commentary.
  - 3. Verify that bracing and guying/cables, if required to secure framing during erection, are installed.
- C. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
  - 1. Minimum inspection requirements using the stated publication are as follows:
    - a. All bolts indicated to be "slip-critical" shall be inspected.
    - b. Two bolts in each bearing type bolted connection between girders and columns shall be inspected.
    - c. 10 percent of the remaining bolts, but not less than 2 in each connection shall be inspected.

2. Bolts that fail shall be retightened and all remaining bolts in the connection shall be retested. Costs of retests on connections that fail shall be the Contractor's responsibility.
- D. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
  1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
  2. In addition to visual inspection, 100 percent of full-penetration, moment connection field welds shall be ultrasonically tested according to AWS D1.1.
  3. Column splice welds shall be inspected by ultrasonic testing per AWS D1.1 to the following extent:
    - a. Rigid (Lateral) Columns: 100% of splice welds at each level shall be tested.
    - b. Non-Frame Columns: 25% of splice welds at each level shall be tested.
  4. Non-Destructive Testing of Remaining Welds:
    - a. Ultrasonic Testing (UT): ASTM E164
      - 1) Divide connections into groups containing not less than 40 connections. Test 25 percent of the connections in each group. If any weld is rejected, test all the connections in group.
  5. Extent of testing procedure shall be the entire weld length in each designated joint.
  6. Welds found unacceptable shall be repaired by methods permitted in AWS code and be retested. Costs of repair and additional testing shall be the Contractor's responsibility.
- E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
  1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
  2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- F. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

### 3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Cleaning and touchup painting are specified in Section 09 90 00.

END OF SECTION

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SECTION 05 30 00  
ER6.5A METAL DECK

PART 1 - GENERAL

1.1 SUMMARY

- A. The requirements of this specification section include all materials, equipment, and labor necessary to furnish and install a ER6.5A-18/18 gage acoustical roof deck.
- B. ER6.5A-18/18 gage acoustical roof deck shall serve as a structural roof deck and a finished ceiling as indicated on the contract drawings.
- C. ER6.5A-18/18 gage acoustical roof deck shall provide an exposed bottom surface that is substantially flat. The narrow rib openings of the ER6.5A-18/18 gage acoustical roof deck shall provide the appearance of a linear ceiling. Fasteners for sidelaps and overlying roofing materials shall be concealed within the depth of the dovetail shaped ribs.
- D. Ankore™ hanging devices that are specially configured to fit into the dovetail shaped ribs of the ER6.5A-18/18 gage acoustical roof deck shall be available. These hanging devices shall be utilized whenever any related work is suspended from ER6.5A-18/18 gage acoustical roof deck. Ankore™ hanging devices shall be furnished by the installer of the related work unless otherwise indicated.

1.2 RELATED WORK

- A. The following related work is not part of this specification section:
  - 1. Section 05 12 00 - Structural Steel Framing.
  - 2. Section 07 54 19 - Polyvinyl-Chloride PVC-TPA Roofing.
  - 3. Division 23 - Mechanical.
  - 4. Division 26 - Electrical.

1.3 SUBMITTALS

- A. Submit the following items with the conditions of the contract and appropriate specification sections:
  - 1. The manufacturer's specifications, section properties, load tables, diaphragm shear tables, dimensions, finishes, and noise reduction coefficients shall be submitted.
  - 2. Shop drawings shall be submitted showing panel placement, profiles, material thicknesses, finishes, layout, anchorage and openings as dimensioned on the structural drawings.
  - 3. A full width sample shall be submitted as requested to verify compliance with the specifications and the level of quality.

1.4 REFERENCE STANDARDS

- A. Section properties shall be computed in accordance with the American Iron and Steel Institute (AISI) Specification for Design of Cold-Formed Steel Structural Members.
- B. Welding shall comply with the applicable provisions of the American Welding Society (AWS) D1.3 Structural Welding Code-Sheet Steel.
- C. Superimposed load and diaphragm shear capacities shall be computed in accordance with the requirements of the Steel Deck Institute (SDI).

- D. The manufacturer shall have been regularly engaged in the production of a deck section with dovetail shaped ribs for a period of at least ten years.
- E. Noise reduction coefficients shall be verified by the result of sound absorption tests conducted in accordance with ASTM C423 and E795.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. The ER6.5A-18/18 gage acoustical roof deck shall be protected from damage during delivery, storage, and handling.
- B. If storage at the jobsite is required, ER6.5A-18/18 gage acoustical roof deck shall be elevated above the ground, sloped to provide drainage, and protected from the weather with a ventilated covering.

#### 1.6 SUBSTITUTION

- A. Reference in the specification to any product, material, type or form of construction shall establish the minimum standard of quality and performance. These standards shall not be abridged or modified for any reason for the purpose of substitution.
- B. The contractor shall submit any proposed substitution in writing to the Architect of Record for consideration no less than ten calendar days prior to the original bid date. The substitution proposal package shall include, at the architect's option, a sample product, structural and performance data, and finish description. Refer to Section 01 33 00.
- C. This data will be coordinated and reviewed by the project design professionals. Acceptance of any submitted substitution will be so stated and defined by addendum prior to the original bid date. Substitution without addendum is not accepted.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURER

- A. In accordance with the requirements of this specification section, provide products manufactured by EPIC METALS CORPORATION, Rankin, PA. Contact – Scott Short, District Sales Manager; Telephone 412-351-3913, Fax 412-351-2018, Email [sshort@epicmetals.com](mailto:sshort@epicmetals.com).
- B. The type ER6.5A-18/18 gage acoustical roof deck, design thickness, section properties, and NRC shall be shown on the structural design drawings.

#### 2.2 MATERIAL

- A. The ER6.5A-18/18 gage acoustical roof deck shall be cold-formed from steel coils conforming to ASTM A653, structural quality, with a minimum yield strength of 40 ksi.
- B. Before forming, the steel coils shall have received a hot-dip protective coating of zinc conforming to ASTM A924, Class G60, as defined in ASTM A653.
- C. The minimum uncoated thickness of the steel furnished shall not be less than 95% of the design thickness.
- D. To conform with the requirements of the Green Building Rating System of the United States Green Building Council, the ER6.5A-18/18 gage acoustical roof deck shall contribute to the LEED accreditation for Regional Manufacturing proximity under the



Materials and Resources (MR) Section and Credit 5.1 and 5.2 Subsections by supplying product manufactured with a 500 mile radius of this specified project.

## 2.3 FABRICATION

- A. ER6.5A-18/18 gage acoustical roof deck shall have continuous dovetail shaped ribs.
- B. ER6.5A-18/18 gage acoustical roof deck shall have full depth positive registering sidelaps that can be fastened by welds or screws.
- C. ER6.5A-18/18 gage acoustical roof deck shall be fabricated with perforations. The perforated areas shall be located in the bottom flat areas between the dovetail shaped ribs. A minimum NRC value of 1.00 shall be provided. This value shall be established by sound absorption tests without the use of fiberglass insulation above the panels.
- D. After forming and welding, the bottom surfaces of type ER6.5A-18/18 gage acoustical roof deck shall be prime painted with Epic's standard white. Before painting, the galvanized steel shall be chemically cleaned and coated with an acid wash pretreatment primer followed by a coat of the manufacturer's standard prime paint and then oven baked. Compatibility of the field applied finish paint with the factory applied prime paint shall be the responsibility of the painting contractor.

## 2.4 ACCESSORIES

- A. Ankore™ hanging devices shall be installable and relocatable along the length of the interior ribs of the ER6.5A-18/18 gage acoustical roof deck. The manufacturer's product data shall be consulted for minimum spacing, load capacities, and proper installation procedure of the Ankore™ hanging devices.
- B. The manufacturer's standard ridge plates, valley plates, transition plates, and closures shall be provided as indicated on the structural drawings.
- C. Openings and reinforcement for openings noted specifically by the deck manufacturer on the structural drawings shall be provided.
- D. Acoustic elements shall be factory installed above the perforations in the bottom flat area between the dovetail shaped ribs. To facilitate field painting of the perforated surfaces, the sound absorbing elements shall be supported above the surface. Sound absorbing elements and spacers shall be factory installed.
- E. Access Panels: Refer to drawings for locations. Provide access panels to run electrical and data wire in panel ribs. Panels shall be located near steel structure.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. The ER6.5A-18/18 gage acoustical roof deck shall be installed in strict accordance with the manufacturer's instructions, approved erection drawings, and all applicable safety regulations.

### 3.2 BEFORE INSTALLATION

- A. The supporting frame and other work relating to the ER6.5A-18/18 gage acoustical roof deck shall be examined to determine if this work has been properly completed.

- B. Bundles of material shall be located on the supporting frame in such a manner that overloading of any individual framing members does not occur.
- C. All components of the ER6.5A-18/18 gage acoustical roof deck shall be protected from significant damage during shipment and handling. If storage at the jobsite is required, bundles or packages of these materials shall be elevated above the ground, sloped to provide drainage, and protected from the elements with a ventilated, waterproof covering.

### 3.3 INSTALLATION

- A. Before being permanently fastened, ER6.5A-18/18 gage acoustical roof deck shall be placed on the supporting frame and adjusted to final position with ends accurately aligned and adequately bearing on the supporting frame. Consistent coverage shall be maintained so that panels located in adjacent bays will be properly aligned.
- B. Cutting of ER6.5A-18/18 gage acoustical roof deck to suit jobsite conditions shall be performed in a neat and professional manner. Only those openings indicated on the structural drawings shall be cut. Other openings shall be cut and reinforced by those requiring the openings as approved by the structural engineer.
- C. The ER6.5A-18/18 gage acoustical roof deck shall be fastened to all supporting members with 3/4" diameter puddle welds at a nominal spacing of 8" on center or less or as indicated on the manufacturer's erection drawings.
  - 1. The sides of ER6.5A-18/18 gage acoustical roof deck located at the perimeter of the building shall be fastened to supporting members with 3/4" diameter puddle welds at a maximum spacing of 36" on center or less as indicated on the manufacturer's erection drawings.
- D. The sidelaps of ER6.5A-18/18 gage acoustical roof deck shall be fastened together with 1 1/2" long fillet welds or #12 screws as indicated on the manufacturer's erection drawings.
- E. Construction loads shall not be applied to ER6.5A-18/18 gage acoustical roof deck until after the panels are permanently fastened to supporting members, and sidelaps are attached. The construction loads shall not exceed the capacity of the panels.
- F. Items such as ceilings, light fixtures, conduit, pipe and ductwork shall not be suspended from ER6.5A-18/18 gage acoustical roof deck without specific approval of the structural engineer.
- G. Sump pans, ridge plates, valley plates, transition plates, eave plates, and supplied reinforcement for small openings shall be fastened as indicated on the manufacturer's erection drawings.

### 3.4 AFTER INSTALLATION

- A. Construction loads that could damage the ER6.5A-18/18 gage acoustical roof deck such as heavy concentrated loads and impact loads shall be avoided. Planking shall be used in all high traffic areas.
- B. Galvanizing and other coatings that are damaged must be field repaired using appropriate methods and shall be the responsibility of the contractor.
- C. Cleaning the bottom surface of the ER6.5A-18/18 gage acoustical roof deck for field painting shall be the responsibility of the contractor.

END OF SECTION

SECTION 05 31 00  
STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Roof deck.
- B. Related Requirements:
  - 1. Section 05 12 00 - Structural Steel Framing for shop- and field-welded shear connectors.
  - 2. Section 05 50 00 - Metal Fabrications for framing deck openings with miscellaneous steel shapes.
  - 3. Section 09 90 00 - Painting for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
  - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
  - 1. Power-actuated mechanical fasteners.
- D. Evaluation Reports: For steel deck.
- E. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

- C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General: All structural steel materials to be domestically manufactured in the United States of America.
- B. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- D. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- E. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### 2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ASC Profiles, Inc.; a Blue Scope Steel company.
  - 2. Canam United States; Canam Group Inc.
  - 3. CMC Joist & Deck.
  - 4. Consolidated Systems, Inc.; Metal Dek Group.
  - 5. Cordeck.
  - 6. DACS, Inc.
  - 7. Epic Metals Corporation.
  - 8. Marlyn Steel Decks, Inc.
  - 9. New Millennium Building Systems, LLC.
  - 10. Nucor Corp.; Vulcraft Group.
  - 11. Roof Deck, Inc.
  - 12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
  - 13. Verco Manufacturing Co.
  - 14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230) G90 (Z275) zinc coating.
  2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230) G90 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - a. Color: Manufacturer's standard.
  3. Deck Profile: As indicated in the documents.
  4. Profile Depth: As indicated in the documents.
  5. Design Uncoated-Steel Thickness: As indicated in the documents.
  6. Span Condition: Triple span or more.
  7. Side Laps: Overlapped or interlocking seam at Contractor's option.

## 2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon- steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and level or sloped recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.
- K. Galvanizing Repair Paint: ASTM A 780.
- L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

### 3.3 ROOF-DECK INSTALLATION

- A. Deck attachment shall be sufficient to develop diaphragm shear strength capacity indicated on the drawings and shall be in accordance with the manufacturer's recommendations. Attachment guidelines indicated in sections 3.3B through 3.3D are minimum requirements only.
- B. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
  - 1. Weld Diameter: 5/8 inch, nominal.
  - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches in the field of roof and 6 inches (150 mm) apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.

3. Weld Washers: Install weld washers at each weld location where metal thickness is less than 0.028 inches. Weld washers shall have a minimum thickness of 0.0598 inches and have a nominal 3/8 inch diameter whole.
- C. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span, 36 inches, and a minimum of 4 fasteners between supports. Use one of the two attachment methods as follows:
  1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
  2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.
- D. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches (38 mm), with end joints as follows:
  1. End Joints: Lapped 2 inches (51 mm) minimum or butted at Contractor's option.
- E. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches (305 mm) apart with at least one weld or fastener at each corner.
  1. Install reinforcing channels or zeos in ribs to span between supports and weld or mechanically fasten.
- F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
  1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- G. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

### 3.5 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
  2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 09 90 00 - Painting.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION



SECTION 05 40 00  
COLD FORMED METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Load bearing formed steel stud exterior wall framing.

1.2 RELATED SECTIONS

- A. Section 05 12 00 – Structural Steel Framing.
- B. Section 05 31 00 - Steel Decking: Metal floor and roof decking.
- C. Section 06 11 40 - Wood Blocking and Curbing: Rough wood blocking.
- D. Section 07 21 00 - Thermal Insulation: Insulation within framing members.
- E. Section 07 90 00 - Joint Protection.
- F. Section 09 11 10 - Metal Stud Framing System.
- G. Section 09 26 00 - Gypsum Board Systems: Light weight, non-load bearing metal stud framing.
- H. Section 09 51 23 - Acoustical Tile Ceilings: Ceiling suspension system.

1.3 REFERENCES

- A. AISI - American Iron and Steel Institute - Cold-Formed Steel Design Manual.
- B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A653 – Sheet Steel, Zinc-coated (Galvanized) by Hot Dip Process.
- D. ASTM A1011 – Hot-Rolled Carbon Steel Sheet and Strip.
- E. ASTM A1008 – Steel, Cold-Rolled Sheet carbon, Structural.
- F. ASTM C955 - Load-Bearing (Transverse and Axial) Steel Studs, Runners (Track), and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases.
- G. AWCI (Association of Wall and Ceiling Industries) - Specifications Guide for Cold Formed Steel Structural Members.
- H. AWS D1.1 - Structural Welding Code.
- I. AWS D1.3 - Light Steel Welding Code.
- J. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.
- K. MFMA (Metal Framing Manufacturers Association) - Guidelines for the Use of Metal Framing.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.

- B. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of related work.
- C. Indicate stud and roof joist layout sealed and signed by a qualified registered professional structural engineer licensed in the State of Maryland.
  - 1. Indicated description of design criteria
  - 2. Engineering analysis depicting member stresses and deflection.
  - 3. Member sizes, gauges and connections.
  - 4. Member truss support reactions.
  - 5. Top chord, bottom chord and web tracing requirements.
- D. Describe method for securing studs to tracks and for bolted or welded framing connections.
- E. Product Data: Provide data on standard framing members; describe materials and finish, product criteria and limitations.
- F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- G. Delegated Design Submittal: For cold formed metal framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Show cold formed metal framing types, connections, types of bracing including special reinforcement. Indicate location, type, magnitude and direction of loads imposed on the building structural frame from cold formed metal framing.

## 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum five (5) years documented experience and approved by manufacturer.

## 1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

## 1.7 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.
- B. Coordinate with the placement of components within the stud framing system.

# PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Marino Industries Corp of South Plainfield, NJ
- B. ClarkDietrich Building Systems of Baltimore, MD
- C. Substitutions: Under provisions of the General Conditions to the Contract for Construction.

## 2.2 FRAMING MATERIALS

- A. Studs: ASTM C955, formed to channel shape, solid web, knurled faces; 16 gage thick minimum, 1 5/8 inch face and 6 inch depth. Final gage to be determined through Delegated Design. Submit engineering stamped drawings for any substitution.
- B. Joists: Grade sheet steel, formed to channel shape, punched web; 16 gage thick, 1 1/2 inch face, 10 inch depth.
- C. Track: Formed steel; channel shaped; same width as studs, tight fit; 16 gage thick, solid web.

## 2.3 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered.
- B. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered.
- C. Touch-Up Primer for Galvanized Surfaces: SSPC - Paint 20 Type I Inorganic zinc rich.

## 2.4 FASTENERS

- A. Self-drilling, Self-tapping Screws, Bolts, Nuts and Washers: ASTM A123, hot dip galvanized to 1.25 oz/sq ft.
- B. Anchorage Devices: Drilled expansion bolts.
- C. Welding: In conformance with AWS D1.1 and AWS D1.3.

## 2.5 FABRICATION

- A. Fabricate assemblies of framed sections of sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.
- B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

## 2.6 FINISHES

- A. Studs: Galvanize to CP 60 coating class.
- B. Tracks and Headers: Galvanize to CP 60 coating class.
- C. Joists: Galvanize to CP 60 coating class.
- D. Bracing, Furring, Bridging: Same finish as framing members.
- E. Plates, Gussets, Clips: Same finish as framing members.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 31 00.
- B. Verify that building framing components are ready to receive work.

### 3.2 ERECTION OF STUDDING

- A. Install components in accordance with manufacturer's instructions.
- B. Align floor and ceiling tracks; locate to partition layout. Secure in place with fasteners by welding at maximum 24 inches oc. Coordinate installation of sealant with floor and ceiling tracks.
- C. Place studs at 16 inches o.c. or 12" o.c. within 6'-0" of corners; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method.
- D. Construct corners using minimum three studs. Double stud wall openings, door and window jambs.
- E. Erect load bearing studs one piece full length. Splicing of studs is not permitted.
- F. Erect load bearing studs, brace, and reinforce to develop full strength, to achieve design requirements.
- G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- H. Install intermediate studs above and below openings to align with wall stud spacing.
- I. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
- J. Attach cross studs to studs for attachment of fixtures anchored to walls.
- K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- L. Touch-up field welds and damaged galvanized surfaces with primer.

### 3.3 ERECTION OF JOISTS

- A. Install framing components in accordance with manufacturer's instructions.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.
- C. Place joists as indicated at 16 inches o.c.; not more than 2 inches from abutting walls. Connect joists to supports using fastener method.
- D. Set floor joists parallel and level, with lateral bracing and bridging.
- E. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track.
- F. Provide web stiffeners at reaction points.
- G. Touch-up field welds and damaged galvanized surfaces with zinc rich primer.

### 3.4 ERECTION TOLERANCES

- A. Maximum Variation from True Position: 1/4 inch in ten (10') feet.
- B. Maximum Variation of any Member from Plane: 1/8 inch.

END OF SECTION

SECTION 05 50 00  
METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Shop fabricated ferrous metal items, galvanized and prime painted.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 03 30 00 - Cast-In-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.

1.3 RELATED SECTIONS

- A. Section 05 12 00 - Structural Steel: Structural steel column anchor bolts.
- B. Section 05 30 00 - ER6.5 Steel Deck.
- C. Section 05 31 00 - Steel Decking: Bearing plates and angles and frame openings for metal deck bearing, including anchorage.
- D. Section 05 73 00 - Handrails and Railings.
- E. Section 09 90 00 - Painting: Paint finish.

1.4 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- C. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
- D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
- F. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
- G. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- H. ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.
- I. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- J. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- K. ASTM B177 - Chromium Electroplating on Steel for Engineering Use.
- L. AWS A2.0 - Standard Welding Symbols.

M. AWS D1.1 - Structural Welding Code.

N. SSPC - Steel Structures Painting Council.

## 1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

## 1.6 QUALIFICATIONS

A. Welders' Certificates: Submit under provisions of Section 01 33 00, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

## 1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Drawings and shop drawings.

# PART 2 PRODUCTS

## 2.1 MATERIALS

A. Steel Sections: ASTM A36.

B. Steel Tubing: ASTM A500, Grade B.

C. Plates: ASTM A283.

D. Pipe: ASTM A53, Grade B Schedule 40.

E. Fasteners: As detailed.

F. Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153 for galvanized components.

G. Welding Materials: AWS D1.1; type required for materials being welded.

H. Shop and Touch-Up Primer: SSPC 6 - SP6 Commercial Blast Cleaning and Prime.

I. Touch-Up Primer for Galvanized Surfaces: PPG Zinc rich type 6-209 galvanized steel primer.

## 2.2 FABRICATION

A. Fit and shop assemble in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

## 2.3 FINISHES

- A. Prepare surfaces to be primed in accordance with SSPC SP 6- Commercial Blast Cleaning.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime paint items with PPG Water Base Inhibitive Metal Primer 90-712 at 4.8 mils MWF.
- D. Galvanize in accordance with ASTM A123, structural steel members. Provide minimum 1.25 oz/sq ft galvanized coating.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

### 3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

### 3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on Drawings and shop drawings.
- D. Perform field welding in accordance with AWS D1.1.
- E. Obtain Architect/Engineer approval prior to site cutting or making adjustments not scheduled.
- F. After erection, clean, brush and prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

### 3.4 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

### 3.5 SCHEDULE

- A. The Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.
1. Bollards: Steel pipe, concrete filled, crowned cap; galvanized with painted finishes. Omit quenching process of steel for adequate paint adhesion. Match adjacent bollard, 8” minimum dia., 3’ H and 3’ below grade.
  2. Ledge and Shelf Angles, Channels and Plates Not Attached to Structural Framing: For support of metal decking joists masonry; prime paint finish.
  3. Lintels: As detailed; Interior: prime paint finish;  
Exterior: galvanized finish.
  4. Support steel and bracing for ceiling hung toilet partitions as detailed within contract documents. Prepare in accordance with SS PC-6-SP6 and prime paint.
  5. TV Support Brackets: Tube steel supports as detailed on drawings.
  6. Roof Deck Closer Channels.

END OF SECTION



SECTION 05 73 00  
HANDRAILS AND RAILINGS

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Architectural glass railings.

1.02 RELATED WORK

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 08 80 00 - Glazing.
- C. Section 09 65 00 - Resilient Base and Accessories.
- D. Section 09 30 00 - Tiling.
- E. Section 09 90 00 - Painting.

1.03 REFERENCES

- A. Aluminum Association (AA):
  - 1. AA ABH-21 Aluminum Brazing Handbook.
  - 2. AA ASD-1 Aluminum Standards and Data.
  - 3. AA DAF-45 Designation System for Aluminum Finishes.
  - 4. AA SAA-46 Standards for Anodized Architectural Aluminum.
- B. American Architectural Manufacturers Association (AAMA):
  - 1. AAMA 605.1 Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
  - 2. AAMA 606.1 Voluntary Guide Specifications and Inspection Methods of Integral Color Anodic Finishes for Architectural Aluminum.
  - 3. AAMA 607.1 Voluntary Guide Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
  - 4. AAMA 608.1 Voluntary Guide Specifications and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
- C. American Concrete Institute (ACI):
  - 1. ACI 347 Recommended Practice for Concrete Formwork.
- D. American Institute of Steel Construction (AISC):
  - 1. Manual of Steel Construction.
- E. American Iron and Steel Institute (AISI):
  - 1. Steel Products Manual; Stainless and Heat Resisting Steel.
  - 2. Code of Standard Practice.
- F. American National Standards Institute (ANSI):
  - 1. ANSI A21.1 Safety Requirements for Floor and Wall Openings, Railings and Toe Boards.
  - 2. ANSI A58.1 Minimum Design Loads in Buildings and Other Structures.
  - 3. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities.
  - 4. ANSI A97.1 Safety Performance Specifications and Methods of Test for Safety Glazing Material used in Buildings.
  - 5. ANSI/NAAMM MBG 531 Metal Bar Grating Manual.

- G. ASTM International (ASTM):
1. ASTM A 29 Specification for Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for.
  2. ASTM A 36 Carbon Structural Steel.
  3. ASTM A 47 Specification for Ferritic Malleable Iron Castings.
  4. ASTM A 48 Specification for Gray Iron Castings.
  5. ASTM A 53 Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless.
  6. ASTM A 108 Steel Bars, Carbon, Cold Finished, Standard Quality.
  7. ASTM A 123 Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
  8. ASTM A 167 Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  9. ASTM A 269 Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  10. ASTM A 276 Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
  11. ASTM A 312 Specification for Seamless and Welded Austenitic Stainless Steel Pipe.
  12. ASTM A 500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  13. ASTM A 512 Specification for Cold-Drawn Butt-weld Carbon Steel Mechanical Tubing.
  14. ASTM A 513 Specification for Electric-Resistance-Welded Carbon and Alloy Steel Tubing.
  15. ASTM A 554 Welded Stainless Steel Mechanical Tubing
  16. ASTM A 570 Specification for Steel, Sheet and Strip, Carbon, Hot Rolled, Structural Quality.
  17. ASTM A 575 Specification for Steel Bars, Carbon, Merchant Quality, M Grades.
  18. ASTM A 582 Free Machining Stainless and Heat Resisting Steel Bars.
  19. ASTM A 743 Specification for Corrosion-Resistant Iron Chromium, Iron Chromium-Nickel, and Nickel Base Alloy Castings for General Application.
  20. ASTM A1264-1 Safety Requirements for Workplace Floor and Wall Openings, Stairs and Railing Systems
  21. ASTM B 43 Specification for Standard Sizes of Seamless Red Brass Pipe.
  22. ASTM B 62 Specification for Composition Bronze or Ounce Metal Castings.
  23. ASTM B 209 Specification for Aluminum and Aluminum Alloy Sheet and Plate.
  24. ASTM B 210 Specification for Aluminum and Aluminum Alloy Drawn Seamless Tubes.
  25. ASTM B 211 Aluminum and Aluminum Alloy Bar, Rod and Wire
  26. ASTM B 221 Specification for Aluminum-Alloy Bars, Rods, Wires, Shapes and Tubes
  27. ASTM B 241 Specification for Aluminum and Aluminum Alloy Seamless Pipe and Seamless Extruded Tube.
  28. ASTM B 429 Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
  29. ASTM B 455 Specification for Copper-Zinc-Lead Alloy (Leaded Brass) Extruded Shapes.
  30. ASTM B 483 Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.
  31. ASTM B 584 Specification for Copper Alloy Sand Castings for General Applications.
  32. ASTM C 595 Specification for Blended Hydraulic Cements.
  33. ASTM C 1036 Standard Specification for Flat Glass.
  34. ASTM C 1048 Standard Specification for Heat Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
  35. ASTM C 1172 Standard Specification for Laminated Architectural Flat Glass.

36. ASTM D 1730 Recommended Practices for Preparation of Aluminum and Aluminum Alloy Surfaces for Painting.
  37. ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials.
  38. ASTM E 894 Standard Test Methods for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
  39. ASTM E 935 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
  40. ASTM E 985 Specification for Permanent Metal Railing Systems and Rails for Buildings.
  41. ASTM E 1300 Standard Practice for Determining Load Resistance of Glass in Buildings.
  42. ASTM E 1481 Terminology of Railing Systems in Rails for Buildings.
  43. ASTM E 2353 Standard Test Methods for Performance of Glass in Permanent Glass Railing Systems, Guards & Balustrades.
  44. ASTM E 2358 Standard Specification for Performance of Glass in Permanent Glass Railing Systems, Guards & Balustrades.
- H. American Welding Society (AWS):
1. AWS Specifications for Welding Rods and Bare Electrodes.
- I. Americans with Disabilities Act Standards for Accessible Design (ADASAD).
- J. Copper Development Association (CDA):
1. Standards Handbook, Wrought Copper and Copper Alloy Mill Products, Part 2 - Alloy Data.
  2. Standards Handbook, Cast Copper and Copper Alloy Products, Part 7 - Alloy Data.
  3. Copper, Brass and Bronze Design Handbook for Architectural Applications.
- K. General Service Administration (GSA) Federal Specifications (FS):
1. DD-G-1403 Glass, Plate (Float), Sheet, Figured, and Spandrel (Heat Strengthened and Fully Tempered).
  2. QQ-C-390 Copper Alloy Castings.
  3. QQ-S-766 Stainless Steel, Class 302 or 304.
  4. FS-TT-P-641 Primer Coating, Zinc Dust/Zinc Oxide (for Galvanized Surfaces).
  5. FS-TT-P-645 Primer, Paint, Zinc Chromate, Alkyd Type.
  6. FS-TT-P-645A Primer, Paint, Zinc Chromate, Alkyd Type.
- L. Green Globes System
- M. International Code Council (ICC):
1. International Building Code (IBC).
  2. International Residential Code (IRC).
- N. Iron and Steel Society (ISS):
1. Steel Products Manual
    - a. Sheet Steel.
    - b. Stainless and Heat Resisting Steels.
- O. Military Specifications (MIL):
1. MIL-A-46104 Aluminum Alloy Extruded Rod, Bar, and Shapes, 7001.
  2. MIL-C-5688 Pre-Stretching and Proof-Testing of Wire Rope Assemblies.
  3. MIL-P-1144 Pipe, Corrosion Resistant, Stainless Steel, Seamless or Welded.
  4. MIL-P-25995 Pipe, Aluminum Alloy, Drawn or Extruded.
  5. MIL-R-36516 Rail, Restraint.
  6. MIL-W-87161 Wire Strand, Non-flexible, for Aircraft Control, Oil Free Condition.

- P. National Association of Architectural Metal Manufacturers (NAAMM):
  - 1. NAAMM/NOMMA Metal Finishes Manual.
  - 2. Pipe Railing Manual.
  - 3. Metal Stair Manual.
- Q. National Association of Home Builders (NAHB):
  - 1. NAHB Model Green Home Building Guidelines.
- R. National Association of Home Builders' Research Center (NAHBRC):
  - 1. NAHBRC Review of Fall Safety of Children Between the Ages of 18 Months and 4 Years in Relations to Guards and Climbing in the Built Environment.
- S. National Fire Protection Association (NFPA):
  - 1. NFPA 101 Life Safety Code.
- T. Institute of Building Sciences:
  - 1. Metric Guide for Federal Construction.
- U. U.S. Green Building Council:
  - 1. The Leadership in Energy and Environmental Design (LEED) Green Building Rating System.

#### 1.04 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Submit shop drawings and product data.
  - 1. Show sections and plans of stairs, dimensions and assembly of components.
    - a. Railings.
    - b. Handrail.
    - c. Brackets.
    - d. Reinforcements.
    - e. Anchors.
    - f. Welded and bolted connections.
  - 2. Show field connections.
  - 3. Provide setting diagrams for installation of anchors, location of pockets, weld plates for attachment of rails to structure, and blocking for attachment of wall rail.
  - 4. Indicate required field measurements.
  - 5. Indicate component details, materials, finishes, connection and joining methods, and the relationship to adjoining work.
- C. Submit manufacturer's installation instructions.
- D. Samples:
  - 1. Submit duplicate samples of railing showing style and finish. One approved sample will be returned to Contractor.
  - 2. Submit sample(s) of pipe rail and glass.
  - 3. Certificates:
    - a. Furnish manufacturer's certification that materials meet specification requirements.
    - b. Furnish certification and calculations by an engineer registered in the state where the project is located showing that safety requirements are met.

## 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5-year experience manufacturing similar products.
- B. Installer Qualifications: Minimum 2-year experience installing similar products.
- C. Regulatory Requirements:
  - 1. Components and installation shall be in accordance with state and local code authorities.
  - 2. Components and installation shall comply with current ADASAD or ICC/ANSI A117.1 guidelines.
- D. Certifications:
  - 1. Furnish certification that all components and fittings are furnished by the same manufacturer or approved by the primary component manufacturer.
  - 2. Furnish certification that components were installed in accordance to the manufacturer's engineering data to meet the specified design loads.
- E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish areas designated by Architect.
  - 2. Do not proceed with remaining work until workmanship is approved by Architect.
  - 3. Refinish mock-up area as required to produce acceptable work.

## 1.06 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.
- B. Pre-Installation Meeting:
  - 1. Prior to the beginning of work, conduct a pre-job conference at the job site.
  - 2. Provide seven calendar days' advance written notice ensuring the attendance by competent authorized representatives of the fabricator, building owner's representative, architect and subcontractors whose work interfaces with the Work of this section.
  - 3. Review the specifications to determine any potential problems, changes, scheduling, unique job site conditions, installation requirements and procedures and any other information pertinent to the installation.
  - 4. Record the results of the conference and furnish copies to all participants.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.
- B. Storage on Site:
  - 1. Store material in a location and in a manner to avoid damage. Stacking shall be done in a way, which will prevent bending.
  - 2. Store material in a clean, dry location away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering.
  - 3. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of material.

1.08 PROJECT CONDITION

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.09 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
- B. Ensure that field preparation of Work of this section is completed in time to prevent interruption of construction progress.
  - 1. Field measuring for weld plates, sleeves and insert locations.
  - 2. Field measuring.
  - 3. Anchors or inserts for terrazzo or precast concrete.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: R & B Wagner, Inc (Wagner Companies) located at: 10600 W. Brown Deer Rd.; Milwaukee, WI 53224; Toll Free Tel: 888-243-6914; Tel: 414-214-0444; Fax: 414-214-0450; Email: [request info \(RFQ@mailwagner.com\)](mailto:request info (RFQ@mailwagner.com)); Web: [www.wagnerarchitectural.com](http://www.wagnerarchitectural.com) [www.shopwagner.com](http://www.shopwagner.com)
  - 1. Schedule 40 1.9 Inch (48.2mm) diameter grade 316 satin stainless steel 'Legato' post kits with mechanical fittings and attachment for field installation
  - 2. ½" x 2" Flat Blade Grade 316 Satin Stainless Steel "Legato" post kits with mechanical fittings and attachment for field installation
    - a. Infill: ½ inch thick tempered laminated safety glass panels
      - i. Color: Clear
      - ii. Exposed glass edges (flat polished)
    - b. Clamps: Square
  - 3. Shop fabricate such that no jobsite welding, grinding or cutting is required.
  - 4. Finish: Brushed satin stainless steel #4 finish
  - 5. Post height: 42 inch – 1067 mm
  - 6. Post Configurations:
    - a. End Post Surface Mount
    - b. Mid Post Surface Mount
- B. Heavy duty bottom flange with snap on decorative flange cover.
- C. Substitutions: Not permitted.
- D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 – Product Requirements.

2.02 STRUCTURAL REQUIREMENTS

- A. Delete if not required. Railing assembly shall withstand a minimum concentrated load of 200 pounds (91 kg) applied vertically downward or horizontally in any direction, but not simultaneously, at any point at the top of the guard or handrail.
- B. Railing assembly shall withstand a minimum uniform load of 50 pounds per foot (76 kg/meter) applied horizontally or vertically downward, but not simultaneously, on the guard or handrail.

- C. Guard intermediate rails, balusters, panel fillers, cable infill, or posts shall be designed for a uniform load of not less than 50 pounds per square foot (248 kg/sq. meter) applied horizontally over the gross area of the guard of which they are part. Reactions due to this loading need not be added to the loading specified for the main supporting members of the guard.

## 2.03 MATERIALS AND FINISHES

- A. Stainless Steel:
  - 1. Type 316.
- B. Glass:
  - 1. Laminated, fully tempered, ASTM C 1172, with PVB interlayer.

## 2.04 ARCHITECTURAL GLASS RAILING SYSTEM

- A. Railing system shall be surface mounted.
- B. Rails: Fabricate rails from stainless steel Schedule 40, 316 stainless steel, 1.5" diameter.
- C. Posts: Fabricate posts from 1.9 inch outside diameter.
- D. Infill:
  - 1. Glass: 1/2 inch (13 mm) tempered laminated glass mounted to posts with panel clips, Wagner No. GR 310R.7

## 2.05 FASTENERS

- A. Mechanical fasteners used in the assembly of stainless steel or aluminum railings shall be manufactured from stainless steel.
- B. Exposed mechanical fasteners for use with bronze materials shall be manufactured from yellow brass.
- C. Cement: Hydraulic, ASTM C 595, factory prepared with accelerator.

## 2.06 HANDRAIL BRACKETS

- A. Material: Stainless steel.
- B. Fabrication: Machined.
- C. Glass Mount: GB250, two (2) per glass panel.

## 2.07 FABRICATION

- A. Form rail-to-end post connections and all changes in rail direction by miter elbows.
- B. Form rail-to-end post connections and all changes in rail direction by radius elbows.
- C. Cut material square and remove burrs from all exposed edges, with no chamfer.
- D. Make exposed joints butt tight and flush.
- E. Close exposed ends by use of appropriate end cap.
- F. For posts set in concrete, furnish matching sleeves or inserts not less than 5 inches long.

- G. Locate intermediate rails midway between top rail and finished floor or center line of tread.
- H. Locate intermediate rails equally spaced between top rail and finished floor or center line of tread.
- I. Verify dimensions on site prior to shop fabrication.

## 2.08 WALL MOUNTED HANDRAIL

- A. Rails: Schedule 40, 316 stainless steel, 1.5" dia.
- B. Brackets: MB 3300W, 6'-0" o.c. max. spacing.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Supply items to be cast in concrete, embedded in masonry and placed in partitions.

### 3.03 METAL INTERACTION

- A. When aluminum components come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with a heavy coat of a proper primer.
- B. When aluminum components come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with asphalt paint.
- C. When aluminum components come into contact with cement or lime mortar, exposed aluminum surfaces shall be painted with heavy bodied bituminous paint.
- D. When aluminum components come into contact with cement or lime mortar, exposed aluminum surfaces shall be painted with water-white methacrylate lacquer.
- E. When aluminum components come into contact with cement or lime mortar, exposed aluminum surfaces shall be painted with zinc chromate.

### 3.04 INSTALLATION

- A. Install in accordance with shop drawings and manufacturer's instructions at locations indicated on the drawings.
- B. Erect work square and level, horizontal or parallel to rake of steps or ramp, rigid, and free from distortion or defects detrimental to appearance or performance.



- C. Expansion joints shall be provided as needed to allow for thermal expansion or contraction.

### 3.05 CLEANING

- A. As installation is completed, wash thoroughly using clean water and soap; rinse with clean water.
- B. Do not use acid solution, steel wool or other harsh abrasives.
- C. If stain remains after washing, remove finish and restore in accordance with NAAMM/NOMMA Metal Finishes Manual.
- D. Finish shall not be removed from anodized aluminum.

### 3.06 REPAIR OF DEFECTIVE WORK

- A. Remove stained or otherwise defective work and replace with material that meets specification requirements.
- B. Repair damaged finish as directed by Architect.
- C. Replace defective or damaged components as directed by Architect.

### 3.07 PROTECTION

- A. Protect installed products until completion of project.

END OF SECTION

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SECTION 06 11 40  
WOOD BLOCKING AND CURBING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roof curbs and cants.
- B. Blocking in wall and roof openings.
- C. Wood furring and grounds.
- D. Concealed wood blocking for support of toilet and bath accessories, wall cabinets and wood trim.
- E. Telephone and electrical panel boards.
- F. Preservative treatment of wood.

1.2 RELATED SECTIONS

- A. Section 03 30 00 - Cast-in-Place: Concrete openings to receive wood blocking.
- B. Section 04 20 00 - Unit Masonry: Masonry openings to receive wood blocking.

1.3 REFERENCES

- A. ALSC (American Lumber Standards Committee) - Softwood Lumber Standards.
- B. APA (American Plywood Association).
- C. AWWA (American Wood Preservers Association) C1 - All Timber Products Preservative Treatment by Pressure Process.
- D. AWWA (American Wood Preservers Association) C20 - Structural Lumber Fire Retardant Treatment by Pressure Process.
- E. NFPA (National Forest Products Association).
- F. RIS (Redwood Inspection Service).
- G. SPIB (Southern Pine Inspection Bureau).
- H. WCLIB (West Coast Lumber Inspection Bureau).
- I. WWPA (Western Wood Products Association).

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the following agencies:
  - 1. Lumber Grading Agency: Certified by ALSC.
  - 2. Plywood Grading Agency: Certified by APA.

## 1.5 SUBMITTALS

- A. Product Data: In accordance with Section 01 33 00, submit manufacturer's certification for pressure-treated and fire-treated lumber.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Lumber Grading Rules: WCLIB and WWP.
- B. Miscellaneous Framing: Stress Group D, S.P.F. species, 19 percent maximum moisture content, pressure preservative treat when wood is in contact with concrete, masonry or metal.
- C. Plywood: APA Grade C-C-X; unsanded.
  - 1. Fire Retardant Treated: Locations as indicated in Drawings or as listed below.
  - 2. Tongue and Groove: As indicated in Drawings.
- D. Particle board: Will not be acceptable.

### 2.2 ACCESSORIES

- A. Fasteners and Anchors:
  - 1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
  - 2. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

### 2.3 INTERIOR FACTORY WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment) EPA Approved: AWP Treatment C1 using water borne preservative with 0.060 L.I.S. CF retainage.
  - 1. Products treated with "CCA" (chromated copper arsenate) will not be permitted.
  - 2. "ACQ" (amine copper quaternary) or "CBA" (copper boron azole) treated products will be acceptable.
- B. Fire Treatment: Shall be equal to Hoover Treated Wood Products, Inc. of Milford, VA (804) 633-5021 Pyro-Guard Complying with AWP Type A fire retardant treatment and shall have a flame spread rating of 25 or less when tested in accordance with ASTM E-84.
  - 1. Interior Fire retardant treated lumber and plywood shall have an equilibrium moisture content of not over 19% for lumber and 15% for plywood when tested in accordance with ASTM D-3201 at 92% relative humidity.
  - 2. Each piece of fire retardant treated lumber and plywood shall be manufactured under Underwriters Laboratories and shall bear the UL Qualification label for surface burning characteristics in the 30 minute E-84 flame test and also indicate kiln drying after treatment (KDAT).
  - 3. Other Acceptable Manufacturers:
    - a. Dricon Fire Retardant Treated Wood.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Fire retardant treated wood used in structural applications shall be installed in accordance with the conditions and limitations listed in ESR-1791 as issued by the ICC Evaluation Service Inc.
- B. Fire retardant treated wood shall be installed in compliance with the requirements of the applicable building codes and product recommendations.
- C. Fire retardant treated wood shall not be installed in areas where in service it is exposed to precipitation, direct weeing, or condensation.
- D. As with untreated wood, avoid exposure to precipitation during shipping, storage or installation. Apply a water resistive barrier or underlayment over dry sheathing as soon as practical to avoid precipitation on the panel. Panels that get wet should be allowed to dry before covering or be replaced.

### 3.2 SCHEDULE

- A. Concealed blocking in walls.
- B. Telephone and Electric Backboards (to remain unpainted).

END OF SECTION

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SECTION 06 16 43  
GYPSUM SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Fiberglass-mat faced, exterior gypsum sheathing.
- B. Related Sections:
  - 1. Section 05 40 00 – Cold Formed Metal Framing.
  - 2. Section 09 26 00 – Gypsum Board Systems.

1.2 REFERENCES

- A. ASTM International (ASTM):
  - 1. ASTM C473 Standard Test Methods for Physical Testing of Gypsum Panel Products.
  - 2. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - 3. ASTM C1002 Standard Specification of Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
  - 4. ASTM C1177 Standard Specification for Glass Mat Gypsum Sheathing for use as Sheathing.
  - 5. ASTM C1280 Standard Specification for Application of Gypsum Sheathing.
  - 6. ASTM D3273 Standard Test Method of Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
  - 7. ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.
  - 8. ASTM E72 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
  - 9. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.
  - 10. ASTM C1396 Standard Specification for Gypsum Board.
  - 11. ASTM E136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
  - 12. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. Gypsum Association (GA): GA-253 Application of Gypsum Sheathing.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's specifications and installation instructions for each product specified..

1.4 WARRANTY

- A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay) commencing with the date of installation of the product in such structure.
- B. Manufacturer's Warranty:
  - 1. Five years against manufacturing defects from the date of purchase of the product for installation.

## PART 2 - PRODUCTS

### 2.1 MAUFACTURERS

- A. Georgia-Pacific Gypsum LLC.
- B. American Gypsum.
- C. USG
- D. Certainteed.

### 2.2 MATERIALS

- A. Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177.
  - 1. Thickness: ½ inch.
  - 2. Width: 4 feet.
  - 3. Length: 10 feet.
  - 4. Weight: 1.9 lbs/sq. ft.
  - 5. Edges: Square.
  - 6. Surfacing: Fiberglass mat on face, back, and long edges.
  - 7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 540 lbs per sq. ft., dry.
  - 8. Flexural Strength, Parallel (ASTM C473): 80 lbf, parallel.
  - 9. Humidified Deflection (ASTM C1177): Not more than 2/8 inch.
  - 10. Permeance (ASTM E96): Not less than 23 perms.
  - 11. R-Value (ASTM C518): 0.56.
  - 12. Mold Resistance (ASTM D3273): 10, in a test as manufactured.
  - 13. Microbial Resistance (ASTM D6329, UL Environmental GREENGUARD 3-week protocol): Will not support microbial growth.
- B. Fire-Rated Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177, Type X:
  - 1. Thickness: 5/8 inch.
  - 2. Width: 4 feet.
  - 3. Length: 10 feet.
  - 4. Weight: 2.5 lbs/sq. ft.
  - 5. Edges: Square.
  - 6. Surfacing: Fiberglass mat on face, back, and long edges.
  - 7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 654 lbs per sq. ft., dry.
  - 8. Flexural Strength, Parallel (ASTM C11773): 100 lbf, parallel.
  - 9. Humidified Deflection (ASTM C1177): Not more than 1/8 inch.
  - 10. Permeance (ASTM E96): Not less than 17 perms.
  - 11. R-Value (ASTM C518): 0.67.
  - 12. Mold Resistance (ASTM D3273): 10, in a test as manufactured.
  - 13. Microbial Resistance (ASTM D6329, UL Environmental GREENGUARD 3-week protocol): Will not support microbial growth.

### 2.3 ACCESSORIES

- A. Screws: ASTM C1002, corrosion resistant treated.



### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions:
  - 1. Inspection: Verify that project conditions and substrates are acceptable, to the installer, to begin installation of work of this section.

#### 3.2 PROTECTION

- A. General: In accordance with GA-253, ASTM C1280, and the manufacturer's recommendations.
  - 1. Manufacturer's Recommendations:
    - a. Current "Product Catalog", Georgia-Pacific Gypsum.
    - b. The Gypsum Construction Handbook, latest edition.

#### 3.3 PROTECTION

- A. Protect gypsum board installations from damage and deterioration until date of Substantial Completion.

END OF SECTION

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SECTION 06 20 00  
FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Finish carpentry items, including finish trim.
- B. Hardware and attachment accessories.

1.2 RELATED SECTIONS

- A. Section 06 11 40 - Wood Blocking and Curbing: Grounds and support framing.
- B. Section 06 42 19 - Manufactured Plastic-Laminate Clad Casework.
- C. Section 08 21 00 - Flush Wood Doors.
- D. Section 08 80 00 - Glazing: Glass and glazing of wood partitions screens.
- E. Section 09 90 00 - Painting: Painting and finishing of finish carpentry items.

1.3 REFERENCES

- A. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- B. AWI - Quality Standards.
- C. AWP (American Wood Preservers Association) C2 - Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes.
- D. AWP (American Wood Preservers Association) C20 - Structural Lumber Fire Retardant Treatment by Pressure Process.
- E. BHMA A156.9 - Cabinet Hardware.
- F. FS MMM-A-130 - Adhesive, Contact.
- G. HPMA (Hardwood Plywood Manufacturer's Association) HP - American Standard for Hardwood and Decorative Plywood.
- H. NEMA (National Electric Manufacturers Association) LD3 - High Pressure Decorative Laminates.
- I. NHLA (National Hardwood Lumber Association).
- J. NWWDA (National Wood Window and Door Association) I.S.4 - Water Repellent Preservative Treatment for Millwork.
- K. PS 1 - Construction and Industrial Plywood.
- L. PS 20 - American Softwood Lumber Standard.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories, to a minimum scale of 1-1/2 inch to 1 ft.
- C. Provide instructions for attachment hardware.
- D. Samples: Submit two samples of 12 inch in size illustrating wood grain and specified finish.
- E. Submit two samples of wood trim six (6) inches long.

#### 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with AWI Premium Custom Economy quality. NHLA.

#### 1.6 QUALIFICATIONS

- A. Fabricator: Company specializing in fabricating the products specified in this section with minimum five (5) years documented experience.

#### 17 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
- B. Protect work from moisture damage.

#### 1.8 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

#### 1.9 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.

### PART 2 PRODUCTS

#### 2.1 LUMBER MATERIALS

- A. Softwood Lumber: PS 20; Graded in accordance with AWI Custom; white pine species, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
- B. Hardwood Lumber: Graded in accordance with AWI Custom Premium; Sapele Mahogany species, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

#### 2.2 SHEET MATERIALS

- A. Softwood Plywood: PS 1 Grade C-D; Graded in accordance with AWI Custom; veneer lumber core; White Pine species, cut.
- B. Wood Particleboard: Will not be permitted.

## 2.3 FASTENERS

- A. Fasteners: Of size and type to suit application; galvanized finish in concealed locations and stainless steel finish in exposed locations.
- B. Concealed Joint Fasteners: Threaded steel.

## 2.4 ACCESSORIES

- A. Lumber for Shimming: Softwood lumber of cedar species.
- B. Primer: Alkyd primer sealer type.
- C. Wood Filler: Solvent Oil base, tinted to match surface finish color.

## 2.5 FABRICATION

- A. Fabricate to AWI Custom standards.
- B. Shop assemble work for delivery to site, permitting passage through building openings.
- C. Fit exposed sheet material edges with 3/8 inch (9.5 mm) matching hardwood veneer or plastic laminate edging matching adjacent surface. Use one piece for full length only.
- D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

## 3.2 INSTALLATION

- A. Install work in accordance with AWI Custom Quality Standard.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
- D. Install components and trim with nails, screws, or bolts with blind fasteners at 16 inch on center.
- E. Install hardware in accordance with manufacturer's instructions.

## 3.3 ERECTION TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

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SECTION 06 40 00  
INTERIOR ARCHITECTURAL WOODWORK

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Solid wood trim.
- B. Related Sections include the following:
  - 1. Section 06 11 40 – Wood Blocking and Curbing: Wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
  - 2. Section 08 21 00 – Flush Wood Doors.
  - 3. Section 09 90 00 – Painting: Field finishing of interior architectural woodwork.

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.4 PERFORMANCE REQUIREMENTS

- A. Requirements in this article are examples only and are based on typical requirements of model codes. For some occupancy categories under certain circumstances, model codes have less-stringent provisions; revise to suit Project and to comply with requirements of authorities having jurisdiction. Verify, with manufacturers, that their impact-resistant handrails can comply.
- B. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Uniform load of 50 lbf/ft. applied in any direction.
  - 2. Concentrated load of 250 lbf applied in any direction.
  - 3. Uniform and concentrated loads need not be assumed to act concurrently.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated, handrail brackets, and finishing materials and processes.
- B. Product Data: For plywood, high-pressure decorative laminate, adhesive for bonding plastic laminate, handrail brackets, and finishing materials and processes.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show details full size.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

- D. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
  - 1. Shop-applied transparent finishes.

- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.
  - 1. Provide AWI certification labels or compliance certificate indicating that woodwork complies with requirements of grades specified.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

#### 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
  - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

#### 1.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.



## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species and Cut for Transparent Finish: Hardwood, plain sawn or sliced, free of appearance defects, and selected for compatible grain and color.
- C. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- D. High-Pressure Decorative Laminate: NEMA LD 3.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that are incorporated into the Work include the following: Provide selections from a combination of the following manufactures:
    - a. Wilsonart, Formica, Pionite, Nevamar.
- E. CABINET HARDWARE AND ACCESSORIES
  - 1. General: Provide cabinet hardware and accessory materials for a complete installation of architectural woodwork, except for items specified in Division 8 Section "Door Hardware."
  - 2. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
  - 3. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, self-closing
  - 4. Pulls: Back mounted, 5 inches long, 5/16 inches in diameter, brushed stainless steel wire pull.
  - 5. Catches: Magnetic, BHMA A156.9, B03141.
  - 6. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
  - 7. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091 and rated for the following loads:
    - a. Box Drawer Slides: 100 lbf.
    - b. File Drawer Slides: 150 lbf.
  - 8. Drawer Slides: Bottom-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings rated for the following loads:
    - a. Box Drawer Slides: 150 lbf.
      - 1) Provide - Knappe & Vogt KV 8500-16"
  - 9. Exposed Hardware Finishes: Complying with BHMA A156.18 for BHMA finish number indicated.
    - a. General: Brushed Nickel
- F. INSTALLATION MATERIALS
  - 1. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
  - 2. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

### 2.2 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide Custom grade interior woodwork complying with the referenced quality standard.

- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
- D. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
  - 1. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs.
  - 2. Seal edges of openings in countertops with a coat of varnish.
  - 3. For trim items wider than available lumber, use veneered construction. Do not glue for width.
  - 4. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
  - 5. Assemble casings in plant except where limitations of access to place of installation require field assembly.
- E. Plastic-Laminate Cabinets: Refer to Custom Casework section 06 41 00
- F. Plastic-Laminate Countertops: Refer to Custom Casework section 06 41 00 and Color schedule.
- G. 3mm PVC Edging:
  - 1. Provide 3mm pvc edging as indicated for all casework.
  - 2. Color to be Wood Tape brand, as selected from manufacturer's full range of colors.
- H. Grommets:
  - 1. Grommets shall be located in the field by the Owner; drilled and installed by the contractor.
  - 2. Manufacturer: Doug Mockett
    - a. Model No. MM3
    - b. Color: To Be Determined
- I. Wire Management Hanger:
  - 1. Refer to drawings for locations
  - 2. Manufacturer: Doug Mockett
    - a. Model No. WM9
    - b. Color: To Be Determined
- J. Interior Standing and Running Trim
  - 1. Grade: Premium.
  - 2. Wood Species and Cut: Maple, plain sawn. Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated.
    - a. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
  - 3. Provide shapes and sizes as indicated on drawings.
  - 4. For trims, treads and risers, and stair handrails wider or thicker than available lumber, use veneered construction. Do not glue for width or thickness.
  - 5. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
  - 6. Assemble casings in plant except where limitations of access to place of installation require field assembly.
  - 7. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.

## PART 3 – EXECUTION

### 3.1. PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

### 3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

### 3.4 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

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SECTION 06 41 00  
CUSTOM CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Special fabricated cabinet units.
- B. Countertops and supports.
- C. Cabinet hardware.
- D. Prefinished surfaces and preparation for site finishing.
- E. Preparation for installing utilities.
- F. Miscellaneous shelving and built-in storage units.

1.2 RELATED SECTIONS

- A. Section 06 11 40 - Wood Blocking and Curbing: Grounds and support framing.
- B. Section 06 20 00 - Finish Carpentry: Related trim not specified in this section.
- C. Section 09 90 00 - Painting: Finishing cabinet exterior and interior.

1.3 REFERENCES

- A. ANSI/BHMA A156.9 - Cabinet Hardware.
- B. AWI - Quality Standards.
- C. FS MM-L-736 - Lumber, Hardwood.
- D. FS MMM-A-130 - Adhesive, Contact.
- E. National Electric Manufacturers Association (NEMA) LD3 - High Pressure Decorative Laminates.
- F. PS 1 - Construction and Industrial Plywood.
- G. PS 20 - American Softwood Lumber Standard.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location, and schedule of finishes.
- C. Samples: Submit two, 12 x 12 inch size samples, illustrating cabinet finish.
- D. Samples: Submit two, 12 x 12 inch size samples, illustrating countertop finish.
- E. Samples: Submit two samples of drawer pulls, hinges and door glides, illustrating hardware finish.

## 1.5 QUALITY ASSURANCE

- A. Perform cabinet construction in accordance with AWI Premium quality; perform drawer and door front construction in accordance with AWI Custom quality.

## 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

## 1.7 MOCKUP

- A. Provide mockup of full size base cabinet and upper cabinet under provisions of Section 01 40 00.
- B. Provide units with specified countertop; with hardware installed.
- C. Units will be examined to ascertain quality and conformity to AWI quality level standards and specification requirements.
- D. Mockup may remain as part of the Work.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products to site under provisions of Section 01 60 00.
- B. Protect units from moisture damage.

## 1.9 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

## 1.10 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00 .
- B. Coordinate the work with plumbing and electrical rough-in.

# PART 2 PRODUCTS

## 2.1 FABRICATORS

- A. Beachley Millwork, Cavetown, MD  
Contact: Larry Taylor  
Phone: 301-733-7940  
Email: ltaylor@cavetown.com
- B. Martin Millwork, Inc., Mercersburg, PA  
Phone: 717-328-5640  
Email: mmwestimating@centurylink.net
- C. Maryland Millwork, Inc., Hagerstown, MD  
Contact: Dan Myers  
Phone: 301-733-4600  
Email: danm@marylandmillwork.com
- D. Substitutions: Under provisions of Section 01 60 00.

## 2.2 WOOD MATERIALS

- A. Hardwood Lumber: FS MM-L-736; graded in accordance with AWI Custom; average moisture content of 6 percent; species and grade as follows:

ITEM	SPECIES	CUT
Cabinet Frame	White Oak	Plain-Slice
Exposed Stiles and Rails	White Oak	Plain-Slice
Internal Construction	Douglas Fir	Plain-Slice

## 2.3 SHEET MATERIALS

- A. Hardwood Plywood: PS 51; graded in accordance with AWI, core materials of veneer, type of glue recommended for application; face veneer and cuts as follows:

ITEM	FACE SPECIES	CUT
Door and Drawer Fronts	White Oak	Plain Slice
Drawer Construction	White Oak	Plain Slice
Gables and Backs	White Oak	Plain Slice

- B. Medium Density Overlay Board: Minimum 3/4 inches thick graded in accordance with AWI “Premium” grade and make with high waterproof resin adhesive and sanded faces.

- C. Hardboard: is not acceptable.

## 2.4 MANUFACTURERS - PLASTIC LAMINATE & SOLID SURFACE

- A. Formica Product, HGPL.
- B. Nevamar
- C. Wilson Art
- D. Substitutions: Under provisions of Section 01 60 00.

## 2.5 LAMINATE AND SOLID SURFACE MATERIALS

- A. Plastic Laminate: AWI, 0.050 inch General Purpose quality; color, pattern, and surface texture as selected.
- B. Laminate Backing Sheet: 0.020 inch Backing Sheet grade, undecorated plastic laminate.
- C. Interior Liner: Melamine 0.20 inch NEMA C120
- D. Solid Surface and Nosing: shall be equal to DuPonts Corian Sierra, Magna and Jewel series 1/2" thick colors to be selected from standard pallet.

## 2.6 ACCESSORIES

- A. Adhesive: Type recommended by AWI and laminate manufacturer to suit application.
- B. Plastic Edge Trim: Extruded convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness; color as selected.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; chromium plated finish in concealed locations and stainless steel finish in exposed locations.
- D. Concealed Joint Fasteners: Threaded steel.

- E. Hardware: (Color to be selected by the Owner and Architect)  
All hardware shall be equal to Doug Mockett and Company unless otherwise noted.
  - 1. Grommet: XG - 3" flip top
  - 2. Table Leg: TL Series 3 inch O.D. by length required with plate leveler and satin chrome finish.
  - 3. Wire Manager: WM-4

## 2.7 FABRICATION

- A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- B. Fit shelves, doors, and exposed edges with 3/8 inch matching hardwood edging. Use one piece for full length only.
- C. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- D. Door and Drawer Fronts: 3/4 inch thick; flush style.
- E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- F. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arrises. Locate counter butt joints minimum 2 feet from sink cut-outs.
- G. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- H. Fabricate metal countertop surfaces pressure glued to plywood core backing with butt welded joints with spline and without visible joints.
- I. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.
- J. Provide cutouts for plumbing fixtures, and inserts. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges.

## 2.8 FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.
- D. Seal, stain and varnish exposed to view surfaces. Brush apply only.
- E. Seal stain and varnish internal exposed to view and semi-concealed surfaces. Brush apply only.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify adequacy of backing and support framing.

### 3.2 INSTALLATION

- A. Set and secure casework in place; rigid, plumb, and level.



- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units and counter tops.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinet and counter bases to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
- G. Construction adhesive or glue shall not be used to facilitate the installation of wall cabinets.

### 3.3 ADJUSTING

- A. Adjust work under provisions of Section 01 73 00.
- B. Adjust moving or operating parts to function smoothly and correctly.

### 3.4 CLEANING

- A. Clean work under provisions of 01 77 00.
- B. Clean casework, counters, shelves, hardware, fittings and fixtures.

END OF SECTION

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SECTION 06 42 19  
MANUFACTURED PLASTIC-LAMINATE CLAD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. All manufactured casework other than units specified in Section 06 41 00.

1.2 RELATED SECTIONS

- A. Section 09 90 00 - Painting: Field painting of exposed metal frame.
- B. Section 11 42 00 – Commercial Kitchen Equipment.
- C. Division 22- Mechanical - Plumbing Piping: Domestic water supply to equipment.
- D. Division 22 - Mechanical - Plumbing Fixtures: Sinks for equipment.
- E. Division 26 - Electrical - Equipment Wiring Systems: Conduit and electrical power to equipment.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate equipment locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, and clearances required.
- C. Product Data: Provide equipment dimensions and construction, equipment capacities, physical dimensions, utility and service requirements and locations, and point loads.
- D. Samples: Submit two samples of exposed finish surfaces, 12 x 12 inch in size illustrating color and finish.
- E. Manufacturer's Installation Instructions: Indicate special installation requirements.
- F. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.4 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01 77 00.
- B. Record actual locations of concealed utility connections.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01 78 20.
- B. Operation Data: Include description of equipment operation, adjusting and testing required.
- C. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.

## 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten (10) years documented experience.

## 17 REGULATORY REQUIREMENTS

- A. Conform to applicable code for equipment.
- B. Conform to UL requirements for fabrication and installation of equipment.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation.

## 1.8 PRE-INSTALLATION CONFERENCE

- A. Convene one week prior to commencing work of this section, under provisions of Section 01 31 00.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
- B. Leave building openings of sufficient size to permit transport of unit to final position.

## 1.10 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

## 1.11 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.
- B. Coordinate equipment installation with size, location and installation of service utilities.

## 1.12 WARRANTY

- A. Provide three year warranty under provisions of Section 01 77 00.  
Note: Minimum 3 year manufacturer's standard warranty.

## PART 2 PRODUCTS

### 2.1 MANUFACTURER

- A. Specified or Scheduled Manufacturers:
  - 1. Stevens Laminate Casework - 3mm PVC full overlay (formerly 2500 Series); Teutopolis, IL 1-217-857-6411
- B. Other Acceptable Manufacturers:
  - 1. TMI Systems Design Corp., 7000 series with radiused corners.
  - 2. LSI Corporation of America, Inc.
  - 3. Cabinets by Design, Inc.
- C. Substitutions: Under provisions of the General Conditions to the Construction Contract.

## 2.2 MATERIALS (LAMINATE CASEWORK)

### A. Core Material.

1. Cabinet components shall be industrial grade particleboard core material meeting ANSI A208.1 1993 standards as tested in accordance with ASTM D 1037-91A standards.
2. Medium density fiberboard (MDF) shall be used in all drawer components and shall be tested in accordance with ANSI A208.2 1994 standards.
3. Industrial hardboard shall be pre-finished 1/4" thickness composed of wood fibers, phenolic resin binders and moisture inhibitors that meet or exceed the hardboard product standard ANSI/AHA A135.4 1988.

### B. Surface Materials.

1. Exposed exteriors shall be high pressure decorative plastic laminate, thermoset to core using catalyzed PVA glue with a minimum average pressure of 90 PSI and average 180 degree F. temperature. High pressure decorative plastic laminate shall meet NEMA LD 3-1995, VGS.028 specification standards.
2. Exposed doors and drawer fronts shall be high pressure decorative plastic laminate, thermoset to core using catalyzed PVA glue with a minimum average pressure of 90 PSI and average 180 degree F. temperature. High pressure decorative plastic laminate shall meet NEMA LD 3-1995, VGS.028 specification standards.
3. Exposed interiors shall be permanently thermofused melamine laminate, fused to core using a minimum average pressure of 320 PSI and average 320 degree F. temperature. Thermofused melamine laminate shall be tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards. (Warranted for life against delamination.)
4. Semi-exposed and concealed surfaces shall be permanently thermofused melamine laminate or high pressure decorative plastic laminate cabinet liner, 0.020" thickness for balanced construction. Thermofused melamine laminate shall be tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards.
5. Exposed backs shall be permanently thermofused melamine laminate, fused to core using a minimum average pressure of 320 PSI and average 320 degree F. temperature. Thermofused melamine laminate shall be tested against the high pressure laminate NEMA LD 3-1995, VGS.028 specification standards. (Warranted for life against delamination.)

### C. Edgings.

1. Exposed exterior cabinet front edges shall be banded with a contrasting or matching Flat Edge rigid PVC extrusion, resistant to chip, crack and high impact for additional durability. Edging shall have a satin finish. Edge banding shall be applied with hot melt adhesive.
2. Door and drawer front edges shall be edged with a contrasting or matching rigid PVC extrusion, 3MM (1/8") in thickness, resistant to chip, crack and high impact for additional durability. Edging shall have a satin finish. The 3MM thick edging shall be applied with hot melt adhesive and shaped to provide radiused edges and radiused corners.
3. Adjustable shelves shall be banded with PVC extrusion, resistant to chip, crack and high impact for additional durability. Edging shall have a satin finish. Edging shall be applied with hot melt adhesive. Flat Edge PVC edging shall be applied to four (4) edges of adjustable shelf.
4. All other interior components, including drawers, shall be banded with a Flat Edge PVC extrusion, resistant to chip, crack and high impact for additional durability. Edging shall have a satin finish. Edging to be machine applied with hot melt adhesive.

D. Hardware.

1. Hinges shall be fully concealed from view when door is closed and shall permit 165 degree door swing. Hinge crank shall be heavy steel with a concealed, integral self-closing spring mechanism. Hinge boss shall be heavy stamp steel. Nylon inserts shall be provided in the door for positive screw attachment. Hinge attachment to sides of cabinet shall employ special 5MM threaded fasteners for additional strength. Hinges shall have three dimensional adjustment capability. Hinge shall have a lifetime guarantee warranted by the hinge manufacturer. Doors less than 48" in height shall have two (2) hinges each door; doors 48"-63" in height shall have three (3) hinges each door; all doors greater than 63" in height shall have four (4) hinges each door.
2. Door catches shall be heavy duty, spring loaded, large diameter (17.5MM-11/16") roller type catch mounted at bottom edge. All doors over 48" in height shall be provided with roller catch at both top and bottom of door.
3. Catch strike plates shall be injection molded ABS, with an integral molded engagement ridge. Strike plate shall also provide a wide face bumper ensuring a positive door stop.
4. Pulls shall be Solid metal bent wire, 4" length, in chrome finish.
5. Drawers and slide out shelves shall be suspended with bottom mount, side and bottom attached nylon roller epoxy coated steel slides to ensure quiet, smooth operation. Lateral stability is achieved through a special formed captive profile. Slides shall have 100 lb. load rating, with both in and out drawer stop, 3" self-close feature and a side adjustment cam allowing 3MM side to side alignment.
6. Drawers specifically noted for full extension file use shall be suspended with bottom mount, side and bottom attached, nylon roller epoxy coated steel slides to ensure quiet, smooth operation. Lateral stability is achieved through a special formed captive profile. Slides shall have 150 lb. load rating, with both in and out drawer stop, and 3" self-close feature. File drawer shall include extruded top mounted molded side rails to accept standard hanging file folders.
7. Kneespace, pencil drawers and keyboard trays shall be designed to permit under counter or support frame mounting, with 100 lb. nylon roller epoxy coated steel slides.
8. Hanger bars shall be heavy chrome plated tubing. Bars shall be securely affixed to cabinet shelves.
9. Tote trays shall be of high impact polystyrene with smooth edges. Each tray to include an identification card holder and shall be suspended from rails securely attached to cabinet verticals.
10. Shelf support clips shall be injection molded clear polycarbonate. Support clips shall incorporate integral molded lock tabs to retain shelf from tipping or inadvertently being lifted out. Support clip shall have 5MM diameter double pin engagement into precision bored hole pattern in cabinet vertical members. Clips shall have a molded ridge which provides pressure against edge of shelving to maintain positive pin engagement. Clip shall be designed in such a manner to provide means for permanent attachment to shelf. Static test load must exceed 200 lb. per clip.
11. Dividers that are 1/4" thick shall be fully adjustable and retained with injection molded clear polycarbonate clip.
12. Locks shall be cylinder type, die cast, with five (5) disc tumbler mechanism. Each lock shall be provided with milled brass key. Master-keying shall be available. Cabinets with multiple locks installed shall be keyed alike by room, with each cabinet keyed differently unless otherwise specified. Locks shall be Remove-A-Core to give flexibility for different pass key options. Locks shall be provided where indicated on drawings.

- E. Work Surfaces.
  - 1. Plastic laminate countertops shall be surfaced with general purpose .050" thick plastic laminate meeting NEMA spec. LD3-1985. Countertop cores shall be 1-1/8" full thickness 45 lb. density industrial grade particle board. Exposed edges shall be covered with same laminate as top surface. Tops shall include backing sheet on underside.
  - 2. Backsplashes and side or end splashes shall be provided as indicated on drawings and shall be surfaced with same laminate as top.
- F. Color Selections.
  - 1. Exposed cabinet exteriors shall be chosen from high pressure decorative plastic laminate selections as described in casework manufacturer's color selector guide.
  - 2. Exposed doors and drawer fronts shall be chosen from high pressure decorative plastic laminate selections as described in casework manufacturer's color selector guide.
  - 3. Semi-exposed and concealed surfaces, including drawer box components, shall be finished in either pearl or grey, as selected from casework manufacturer's standard interior color selections.
  - 4. Exposed interior components, including both faces of shelves and interior face of backs to be as selected from casework manufacturer.
  - 5. Door and drawer front edges shall be chosen from 3MM thick PVC in contrasting or matching colors as described in manufacturer's color guide.
  - 6. Exposed front edges of cabinets, including exposed interior edges in Flat Edge PVC in contrasting or matching colors as described in manufacturer's color guide, or commercial match to selected exposed exterior color, based on availability.
  - 7. Semi-exposed edges of cabinet components, including drawers, shall be standard interior color selections.
  - 8. Solid metal bent wire pulls shall be available in chrome or brass finish; and injection molded pulls in either bent wire or contour design to be available in twenty (20) colors as selected from manufacturer's color selector.
  - 9. Casework of substitute brands with lesser amounts or more restrictive selection requirements will not be considered equal and shall be rejected.
  - 10. Finishes to be laminate manufacturer's matte, suede or equivalent finish as approved by architect. Samples will be reviewed by architect for color, texture and pattern only.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify equipment rough-in under provisions of Section 01 31 00.
- B. Verify that rough-in frames, anchors and supports are accurately placed.

#### 3.2 PREPARATION

- A. Provide rough-in frame and anchors for placement.

#### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with standards required by authority having jurisdiction.

- C. Anchor equipment securely in place.
- D. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- E. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by Architect/Engineer.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start equipment under provisions of Section 01 40 00.

3.5 ADJUSTING

- A. Adjust work under provisions of Section 01 73 00.
- B. Adjust operating equipment to efficient operation.

3.6 DEMONSTRATION

- A. Provide systems demonstration under provisions of Section 01 79 00.
- B. Demonstrate equipment operation and maintenance.

END OF SECTION



SECTION 07 21 00  
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Perimeter insulation under slabs-on-grade.
  - 2. Perimeter wall insulation (supporting backfill).
  - 3. Cavity-wall insulation.
  - 4. Concealed building insulation.
  - 5. Radiant barriers.
  - 6. Vapor retarders.
  - 7. Sound attenuation insulation.
- B. Related Sections include the following:
  - 1. Section 04 20 00 - Unit Masonry for insulation installed in cavity walls and masonry cells.
  - 2. Section 07 21 20 - Board Insulation.
  - 3. Section 07 54 19 - Polyvinyl-Chloride PVC-TPA Roofing for insulation specified as part of roofing construction.
  - 4. Section 09 26 00 - Gypsum Board for installation in metal-framed assemblies of insulation specified by referencing this Section.
  - 5. Section 22 07 00 - Plumbing Insulation.
  - 6. Section 23 07 00 - HVAC Insulation.

1.2 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.3 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
  - 1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
  - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product Test Reports (Information Only): Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.
- D. Research/Evaluation Reports (Information only): For foam-plastic insulation.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Surface-Burning Characteristics: ASTM E 84.
  - 2. Fire-Resistance Ratings: ASTM E 119.
  - 3. Combustion Characteristics: ASTM E 136.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
  - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
  - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
  - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### 2.2 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:
  - 1. Available Manufacturers:
    - a. DiversiFoam Products.
    - b. Dow Chemical Company.
    - c. Owens Corning.
    - d. Pactiv Building Products Division.
  - 2. Type V, 3.00 lb/cu. ft..
- B. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 or 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core on thicknesses up to 4 inches.
  - 1. Available Manufacturers:
    - a. Atlas Roofing Corporation.

- b. Dow Chemical Company.
- c. Rmax, Inc.

## 2.3 GLASS-FIBER BOARD INSULATION

- A. Manufacturers:
  - 1. CertainTeed Corporation.
  - 2. Johns Manville.
  - 3. Knauf Fiber Glass.
  - 4. Owens Corning.
- B. Unfaced, Flexible Glass-Fiber Board Insulation: ASTM C 612, Type IA; ASTM C 553, Types I, II, and III; or ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, passing ASTM E 136 for combustion characteristics; and of the following nominal density and thermal resistivity:
  - 1. Nominal density of 1.0 lb/cu. ft., thermal resistivity of 3.7 deg F x h x sq. ft./Btu x in. at 75 deg F.
  - 2. Nominal density of not less than 1.5 lb/cu. ft. nor more than 1.7 lb/cu. ft., thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F.

## 2.4 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers:
  - 1. CertainTeed Corporation.
  - 2. Guardian Fiberglass, Inc.
  - 3. Johns Manville.
  - 4. Knauf Fiber Glass.
  - 5. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim, vapor-retarder membrane on 1 face.
- D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
  - 1. 3-5/8 inches thick with a thermal resistance of 11 deg F x h x sq. ft./Btu at 75 deg F.
  - 2. 5-1/2 inches thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F.
  - 3. 6-1/2 inches thick with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F.

## 2.5 VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.
- D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

- E. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and with demonstrated capability to bond vapor retarders securely to substrates indicated.

## 2.6 AUXILIARY INSULATING MATERIALS

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- C. Asphalt Coating for Cellular-Glass Block Insulation: Cutback asphalt or asphalt emulsion of type recommended by manufacturer of cellular-glass block insulation.
- D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

## 2.7 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
  - 1. Products:
    - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
    - b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
    - c. Gemco; Spindle Type.
  - 2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
  - 1. Products:
    - a. Gemco; 90-Degree Insulation Hangers.
  - 2. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
  - 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
  - 1. Products:
    - a. AGM Industries, Inc.; RC150.
    - b. AGM Industries, Inc.; SC150.
    - c. Gemco; Dome-Cap.
    - d. Gemco; R-150.
    - e. Gemco; S-150.
  - 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
    - a. Ceiling plenums.
    - b. Attic spaces.
    - c. Where indicated.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

1. Products:
  - a. AGM Industries, Inc.; TACTOO Adhesive.
  - b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
  - c. Gemco; Tuff Bond Hanger Adhesive.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

#### 3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

#### 3.4 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

- A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
  1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
- C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.
- D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

### 3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. On units of foam-plastic board insulation, install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated.
  - 1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 04 Section "Unit Masonry."

### 3.6 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Set vapor-retarder-faced units with vapor retarder in location indicated of construction, unless otherwise indicated.
  - 1. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures.
  - 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
  - 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- E. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
  - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
  - 2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
  - 3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
  - 4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- F. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.
  - 1. Retain insulation in place by metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.

2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

### 3.7 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
- C. Before installing vapor retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- D. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
- E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- F. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

### 3.8 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

### 3.9 INSULATION SCHEDULE

- A. 2" thick extruded polystyrene perimeter insulation. Extend 2' min. around perimeter complete coverage under heated floor.
- B. 2" thick polyisocyanurate cavity wall insulation.
- C. 3 5/8" R-13 Fiberglass batt sound attenuation unfaced in exterior walls.
- D. 6" R-21 Fiberglass batt sound attenuation unfaced
- E. 6" R-21 Foil faced fiberglass insulation.

END OF SECTION

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SECTION 07 21 20  
BOARD INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Adhesive bed.
- B. Board insulation at exterior perimeter foundation wall.

1.2 RELATED SECTIONS

- A. Section 03 30 00 - Cast-In-Place Concrete
- B. Section 04 20 00 - Unit Masonry System
- C. Section 07 21 00 - Thermal Insulation

1.3 REFERENCES

- A. ANSI/ASTM D2842 - Water Absorption of Rigid Cellular Plastics.
- B. ASTM C240 - Testing Cellular Glass Insulating Block.
- C. ASTM C578 - Preformed Cellular Polystyrene Thermal Insulation.
- D. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
- E. FS HH-I-530 - Insulation Board, Thermal, Un-faced, Polyurethane or Polyisocyanurate.
- F. FS HH-I-551 - Insulation Block and Boards, Thermal (Cellular Glass).
- G. FS HH-I-1972/GEN - Insulation Board, Thermal, Faced, Polyurethane or Polyisocyanurate.

1.4 PERFORMANCE REQUIREMENTS

- A. Materials of this Section shall provide continuity of thermal barrier at building enclosure elements.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data on product characteristics, performance criteria and limitations.
- C. Manufacturer's Installation Instructions: Indicate special environmental conditions required for installation, installation techniques and details.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.7 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.

PART 2 PRODUCTS

2.1 MANUFACTURERS - INSULATION MATERIALS (POLYSTYRENE)

- A. Dow  
B. Amoco Foam Products Co.  
C. Foamular

2.2 INSULATION MATERIALS

- A. Foundation, cavity wall, and metal stud window headers:  
1. Polystyrene Insulation: Extruded type, conforming to the following:  
Thermal Resistance R of 5.0 per inch @ 75F  
Thickness Thickness indicated  
Board Size 48 x 96 inch  
Compressive Strength Minimum 30 psi  
Water Absorption In accordance with ANSI/ASTM C272;  
1 percent by volume maximum  
Edges Square edges.  
B. Underslab Insulation. Refer to drawings.

2.3 ADHESIVES

- A. Adhesive: Type recommended by insulation manufacturer for application.

2.4 ACCESSORIES

- A. Tape: Polyethylene self-adhering type, mesh reinforced, 2 inch wide, waterproof adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 41 00.  
B. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.  
C. Verify substrate surface is flat, free of honeycomb and irregularities, materials or substances that may impede adhesive bond.

3.2 INSTALLATION - FOUNDATION PERIMETER (POLYSTYRENE)

- A. Adhere boards to foundation wall perimeter, horizontally. Place boards in a method to maximize contact bedding. Stagger side end joints. Butt edges and ends tight to adjacent board and to protrusions.

- B. Extend boards over control joints, un-bonded to foundation 6 inches on one side of joint.
- C. Immediately following application of board insulation, adhere protective boards over exposed insulation surfaces. Install boards vertically from base of foundation to top of insulation. Butt board joints tight, stagger from insulation.

3.3 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 01 50 00.
- B. Do not permit Work to be damaged prior to covering insulation.

3.4 SCHEDULE

- A. Perimeter foundation wall insulation.
- B. Cavity wall insulation.
- C. Underslab insulation.
- D. Other areas as shown on the drawings.

END OF SECTION

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SECTION 07 26 10  
BELOW GRADE VAPOR RETARDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Application of an underslab vapor retarder.

1.2 RELATED SECTIONS

- A. Section 03 30 00 – Cast-in-Place Concrete.
- B. Section 07 27 26 – Fluid Applied Membrane Air Barriers.
- C. Section 09 30 00 – Tiling.

1.3 REFERENCES

- A. ASTM D1709 - 09 Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- B. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- C. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.
- D. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- E. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
- F. ASTM F1249-01 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.4 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Submit manufacturer's product data and application instructions.

1.5 QUALITY ASSURANCE

- A. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapor retarder.
- B. Obtain vapor retarder materials from a single manufacturer regularly engaged in manufacturing the product.
- C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.6 PRECONSTRUCTION MEETING

- A. Pre-Construction Meeting: Convene one week prior to installation of underslab vapour retarder. Attendees to be as follows: - Architect, Engineer, General Contractor, Vapor Retarder Installer, and Vapor Retarder Manufacturer to discuss the application in detail.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in a clean, dry area in accordance with manufacturer's instructions.
- C. Protect materials during handling and application to prevent damage or contamination.
- D. Ensure membrane is stamped with manufacturer's name, product name, and membrane thickness at intervals of no more than 85" (220 cm).

#### 1.8 ENVIRONMENTAL REQUIREMENTS

- A. Product not intended for uses subject to abuse or permanent exposure to the elements.
- B. Do not apply on frozen ground.

### PART 2 PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. W. R. Meadows, Inc. (Basis of Design)
- B. W.R. Grace.
- C. SIKA
- D. Substitutions in accordance with the General Conditions to the Construction Contract.

#### 2.2 MATERIALS

- A. Plastic Vapor Retarder (Type A) (Under Concrete Slab)
  - 1. Performance-Based Specification: Vapor retarder membrane shall be manufactured from virgin polyolefin resins and shall meet or exceed all requirements of ASTM E1745, Class A.
    - a. Maximum Water Vapor Permeance (ASTM E154 Sections 7, 8, 11, 12, 13, by ASTM E96, Method B or ASTM F1249)
      - 1) As received: 0.0183 perms.
      - 2) After Wetting and Drying: 0.0219 perms.
      - 3) Resistance to Plastic Flow and Temperature: 0.0197 perms.
      - 4) Effect Low Temperature and Flexibility: 0.0212 perms
      - 5) Resistance to Deterioration from Organisms and Substances in Contacting Soil: 0.0198 perms.
    - b. Puncture Resistance (ASTM D1709): >3,500 grams.
    - c. Tensile Strength ASTM E154, Section 9: 52 Lb. Force/Inch
    - d. Proprietary-Based Specification: PERMINATOR 10 mil by W. R. Meadows.
- B. Bituminous Dampproofing (Type B)
  - 1. Spray applied air and vapor barrier membrane shall be equal to Seaboard asphalt Products EF-400.

## 2.3 ACCESSORIES

- A. Plastic Vapor Retarder (Type A)
  - 1. Seam Tape
    - a. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4" (100 mm).
  - 2. Pipe Collars
    - a. Construct pipe collars from vapor retarder material and pressure sensitive tape per manufacturer's instructions.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

- A. Prepare surfaces in accordance with manufacturer's instructions.
- B. Level, tamp, or roll earth or granular material beneath the slab base.

### 3.2 EXAMINATION

- A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

### 3.3 APPLICATION

- A. Install the vapor retarder membrane in accordance with manufacturer's instructions and ASTM E 1643–98.
- B. Unroll vapor retarder with the longest dimension parallel with the direction of the pour.
- C. Lap vapor retarder over footings and seal to foundation walls.
- D. Overlap joints 6" (152 mm) and seal with manufacturer's tape.
- E. Seal all penetrations (including pipes) with manufacturer's pipe boot.
- F. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.
- G. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6" (152 mm) and taping all four sides with tape.

END OF SECTION

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SECTION 07 27 26  
FLUID APPLIED MEMBRANE AIR BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Application of liquid applied asphalt emulsion air/vapor barrier.
- C. Application of materials to provide bridge and seal air leakage pathways in
  - 1. Wall and roof connections and penetrations.
  - 2. Connections to foundation walls.
  - 3. Walls, windows, curtain walls, storefronts, louvers or doors
  - 4. Expansion and control joints.
  - 5. Masonry ties.
  - 6. All other penetrations through the wall assembly.

1.2 RELATED SECTIONS

- A. Section 04 20 00 - Unit Masonry.
- B. Section 07 21 00 - Thermal Insulation.
- C. Section 07 71 00 - Manufactured Roof Specialties.
- D. Section 07 90 00 - Joint Protection.
- E. Section 08 11 00 - Steel Doors and Frames.
- F. Section 08 41 00 - Aluminum Entrances and Storefronts.
- G. Section 09 26 00 - Gypsum Board Systems.

1.3 REFERENCES

- A. ASTM D146-97 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.
- B. ASTM D412-98a(2002)e1 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
- C. ASTM E96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.
- D. ASTM E283-91 (1999) - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- E. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
- F. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.

- G. ASTM E2178-01 - Standard Test Method for Air Permeance of Building Materials.
- H. ASTM E2357 - 05 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

#### 1.4 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Submit manufacturer's product data and application instructions.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Air Barrier Installer shall be currently accredited under the Air Barrier Association of America (ABAA) and ensure applicators are certified in accordance with the ABAA Quality Assurance Program.
- B. Obtain air/vapor barrier materials from a single manufacturer regularly engaged in manufacturing the product.
- C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

#### 1.7 PRECONSTRUCTION MEETING

- A. Preconstruction Meeting: Convene one week prior to commencing Work of this section, in accordance with Section 01 31 00.

#### 1.8 MOCK-UPS

- A. Prior to installation of air/vapor barrier, apply air/vapor barrier as follows to verify details under shop drawing submittals and to demonstrate tie-ins with adjoining construction, and other termination conditions, as well as qualities of materials and execution.
- B. Apply air barrier in field-constructed mock-ups of assemblies specified in Section 09 26 00.
- C. Apply air/vapor barrier in field-constructed mock-ups of assemblies specified in Section 01 60 00.
- D. Construct typical exterior wall panel, 8 feet long by 8 feet wide, incorporating back-up wall, cladding, window and doorframe and sill, insulation, flashing, building corner condition, junction with roof system, foundation wall, and typical penetrations and gaps; illustrating materials interface and seals.
- E. Test mock-up in accordance with ASTM E783 and ASTM E1105 for air and water infiltration.
- F. Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover any installed air and vapor barrier membrane unless it has been inspected, tested and approved.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

- B. Store materials in a clean dry area in accordance with manufacturer's instructions.
- C. Store at temperatures above 32°F, free from contact with cold or frozen surfaces.
- D. Protect materials during handling and application to prevent damage or contamination.

#### 1.10 ENVIRONMENTAL REQUIREMENTS

- A. Product not intended for uses subject to abuse or permanent exposure to the elements.
- B. Do not proceed with product application during rain or inclement weather.
- C. Do not apply membrane when air or surface temperatures are below 30°F (-1°C).
- D. Do not apply to frozen substrate.

### PART 2 PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. W. R. Meadows, Inc. (Basis of Design)
- B. W. R. Grace.
- C. SIKA.
- D. Carlisle (Barritech VP)
- E. Substitutions in accordance with Section 01 60 00.

#### 2.2 MATERIALS

- A. Liquid Air Vapor Barrier System: One component, polymer modified, cold applied liquid air/vapor barrier membrane.
  - 1. Performance Based Specification: Air/vapor barrier membrane shall be an elastomeric asphalt emulsion having the following characteristics:
    - a. Air Permeability ASTM E2357: 0.04 cfm / ft<sup>2</sup> @ 75 Pa (1.57 lbs / ft<sup>2</sup>).
    - b. Air Permeability ASTM E2178: 0.004 cfm / ft<sup>2</sup> @ 75 Pa (1.57 lbs / ft<sup>2</sup>).
    - c. Water Vapor Permeance ASTM E96 (Method B): ≤0.1 perms.
    - d. Elongation ASTM D412: 1500 %.
    - e. Tensile Strength ASTM D412: 15 psi.
  - 2. Proprietary Based Specification: AIR-SHIELD LM by W. R. MEADOWS.

#### 2.3 ACCESSORIES

- A. Flashing and Transition Membrane: Self-adhesive polymeric air/vapor barrier membrane having a thickness of 40 mils (1 mm).
  - 1. AIR-SHIELD THRU-WALL FLASHING by W. R. MEADOWS.
- B. Detailing Compound: Single component joint filler for exterior sheathing panels.
  - 1. AIR SHIELD JOINT FILLER by W.R. MEADOWS.
- C. Liquid Flashing: Fluid applied, single component, flashing membrane for rough openings.
  - 1. AIR SHIELD LIQUID FLASHING by W.R. MEADOWS.

- D. Joint Tape: Self adhesive polymeric membrane for joints of plywood and oriented strand board (OSB).
  - 1. AIR SHIELD by W.R. MEADOWS.
- E. Primer:
  - 1. Temperatures above 40°F (4°C): Water Based Primer
    - a. MEL-PRIME™ W/B Water Base Primer by W. R. MEADOWS.
  - 2. Temperatures below 30°F (-1°C): Solvent Based Primer.
    - a. MEL-PRIME VOC Compliant Solvent-Base Primer or Standard Solvent-Base Primer by W. R. MEADOWS.
- F. Pointing Mastic: mastic for sealing penetrations and terminations of membrane.
  - 1. POINTING MASTIC by W.R. MEADOWS.
- G. Concrete Repair Materials: general purpose patching materials.
  - 1. MEADOW-PATCH™ 5 and 20 Concrete Repair Mortars by W.R. MEADOWS.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

#### 3.2 SURFACE PREPARATION

- A. Protect adjacent surfaces not designated to receive air/vapor barrier.
- B. Clean and prepare surfaces to receive air/vapor barrier membrane in accordance with manufacturer's instructions.
- C. Do not apply membrane to surfaces unacceptable to manufacturer.
- D. Concrete surfaces must be clean, free of standing water, ice, snow, frost, dust, dirt, oil, curing compounds or any other foreign material that could prevent proper adhesion of the membrane.
- E. Patch all holes and voids and smooth out any surface misalignments.
- F. Patch all cracks, protrusions, small voids, offsets, details, irregularities and small deformities with cementitious patching mortar at least two hours before application.
- G. Ensure joints between dissimilar building materials are sealed with a strip of self-adhesive membrane 6" (150 mm) wide, centered over the joint.
- H. Exterior Sheathing Panels:
  - 1. Install and fasten exterior sheathing panels according to the sheathing manufacturer's instructions.
  - 2. Treat all countersunk and removed fasteners with joint filler or liquid flashing material.
  - 3. Inspect the joint to ensure that all areas to receive joint treatment are clean, dry, smooth, and free from all bond-breaking contaminants.
  - 4. Remove and replace any damaged structural wall components.
  - 5. Joint Treatment using joint filler
    - a. Fill joint area with joint filler using a spreader tool or 3" putty knife.
    - b. Extend the joint filler beyond the joint line 3" onto face of exterior sheathing.

- c. Fully embed 3” wide reinforcing fabric into the wet joint filler, centered over the joint.
  - d. Run the spreader tool or putty knife over the embedded reinforcing fabric to remove any air bubbles.
- I. Plywood and Oriented Strand Board (OSB):
1. Boards are to be fastened according to board manufacturer.
  2. Apply self-adhesive membrane over all joints.

### 3.3 APPLICATION OF AIR BARRIER SYSTEM

- A. Transition Membrane
1. Prime surfaces to be covered in one working day with applicable primer.
  2. Apply transition membrane with a minimum overlap of 3” onto primed surface at all joints, columns, beams and dissimilar materials.
  3. Roll membrane firmly into place.
  4. Ensure membrane is fully adhered and remove all wrinkles and fish mouths.
  5. Overlap subsequent courses of membrane a minimum of 2” and ensure joints are fully adhered.
  6. Seal top edge of transition membrane with pointing mastic.
- B. Rough Opening Transition Membrane
1. Fluid Applied Transition Membrane using liquid flashing membrane
    - a. Apply a coat of primer on the raw edges of exterior gypsum board.
    - b. Treatment of joints or cracks larger than ¼” and less than ½”.
      - i. Prefill any joints or cracks with the liquid flashing material.
      - ii. Apply a generous bead of material over the joint.
      - iii. Press and spread liquid flashing into the joint.
      - iv. Allow material to skin over prior to full application of liquid flashing into the rough opening.
    - c. Treatment of joints or cracks larger than ½”
      - i. Install backer rod into the joint to control depth of liquid flashing material.
      - ii. Apply a generous bead of material over and into the joint.
      - iii. Press and spread liquid flashing into the joint.
      - iv. Smooth out using a spreader tool or putty knife
      - v. Allow material to cure prior to full application of liquid flashing into the rough opening.
    - d. Apply a bead of liquid flashing in the rough opening starting at the top and continuing around the rough opening.
    - e. Spread the material using a spreader tool or putty knife across the rough opening surface.
    - f. Test the material thickness using a wet mil gauge to ensure that it has a thickness of 12-15 mils.
    - g. Apply a generous bead of liquid flashing material to the vertical surface around the rough opening and spread this material 4” – 6” onto the vertical surface with a spreader tool or putty knife.
    - h. Test the thickness to ensure the material has a thickness of 12-15 mils.
    - i. Allow liquid flashing material to dry before installing any windows, doors, wall assembly, and full air barrier material.
- C. Through Wall Flashing
1. Prime surfaces to be covered in one working day with applicable primer.
  2. Remove release paper prior to application.
  3. Apply through wall flashing at based of masonry walls as indicated on drawings.
  4. Recess through wall flashing 1/2” from the face of the masonry.

5. Apply a bead of pointing mastic if through wall flashing is not embedded into masonry.

D. Air Barrier Membrane

1. Apply air/vapor barrier membrane in accordance with manufacturer's instructions.
2. Thoroughly mechanically mix membrane prior to application.
3. Apply membrane by spray or roller at a minimum coverage rate of 20-25 ft<sup>2</sup>/gal. (60 mils wet, 45 mils dry). Two coats (30 mils wet) may be necessary.
4. Frequently inspect surface area with a wet mil gauge to ensure consistent thickness.
5. Work material into any fluted rib forming indentations.
6. Cured thickness of membrane should be 45 mils dry.
7. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with air/vapor barrier system.

3.4 PROTECTION

- A. Cover air/vapor barrier membrane as soon as possible, since it is not designed for permanent exposure.

END OF SECTION

SECTION 07 42 13  
METAL WALL PANELS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes preformed metal siding system for walls, and soffits, with insulation, related flashings and accessory components.
  - 1. Provide building paper back-up over gypsum sheathed walls.
- B. Related Sections:
  - 1. Section 05 12 00 - Structural Steel Framing: Structural steel building frame.
  - 2. Section 05 40 00 - Cold-Formed Metal Framing: Stud wall framing system.
  - 3. Section 07 21 00 - Thermal Insulation.
  - 4. Section 07 26 00 - Vapor Retarders Vapor Retarders.
  - 5. Section 07 27 26 - Fluid Applied Membrane Air Barriers.

1.2 REFERENCES

- A. American Society of Civil Engineers:
  - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- B. ASTM International:
  - 1. ASTM A606 - Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
  - 2. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
  - 3. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
  - 4. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - 5. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
  - 6. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 7. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - 8. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
  - 9. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

1.3 SYSTEM DESCRIPTION

- A. System: Preformed and prefinished metal siding system of horizontal and vertical profile; site assembled.

1.4 PERFORMANCE REQUIREMENTS

- A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable code.
  - 1. Design Pressure: Minimum 20 lb/sq ft.

- B. Maximum Allowable Deflection of Panel: 1/140 of span.
- C. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.
- D. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
- E. Products: Provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials.
- F. Vapor Retarder: Provide continuity of vapor retarder at building enclosure elements in conjunction with vapor retarders specified in Section 07 26 00.
- G. Air Seal: Provide continuity of air barrier seal at building enclosure elements in conjunction with air seal materials specified in Section 07 27 26.

#### 1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate dimensions, layout, joints, expansion joints, construction details, methods of anchorage, and interface with adjacent materials.
- C. Product Data: Submit data on panels.
- D. Design Data: Submit design calculations.
- E. Samples: Submit two samples of siding, 12 x 12 inch in size illustrating finish color, sheen, and texture.
- F. Manufacturer's Installation Instructions: Submit special procedures.

#### 1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with manufacturer's standards.
- B. Maintain one copy of each document on site.

#### 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.
- C. Design Metal Siding under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Maryland.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.



- B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- C. Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- D. Prevent contact with materials capable of causing discoloration or staining.

#### 1.9 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work for installation of vapor retarder and air barrier seals.
- C. Coordinate Work with installation of adjacent components or materials.

#### 1.10 WARRANTY

- A. Section 01 77 00 - Closeout Procedures: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for metal siding.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURED METAL SIDING

- A. Manufacturers:
  - 1. AEP-Span Model 12"
  - 2. American Building Roofing Model 12"
  - 3. Atas International Inc.
  - 4. Metal-Fab Manufacturing LLC Model MET-FAB 12"
  - 5. Fabral Model
  - 6. Substitutions: Section 01 60 00 - Product Requirements

#### 2.2 COMPONENTS

- A. Exterior Panel and Other Sheet Materials: Minimum 0.040 inch thick precoated aluminum stock; 12 inches wide panel; interlocking edges with 1" reveal.
- B. Soffit Panels: 0.040 inch thick pre-coated aluminum alloy, profile in 12 inch wide panels with 1" reveal; lapped edges.

#### 2.3 ACCESSORIES

- A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant; color as selected.
- B. Sealants: Specified in Section 07 90 00. Manufacturer's standard type suitable for use with installation of system; non-staining, non-shrinking and non-sagging; color as selected.
- C. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers; fastener cap same color as exterior panel.
- D. Power Actuated Fasteners: Steel, hot dip galvanized; with soft neoprene washers, fastener cap same color as exterior panel.

- E. Field Touch-up Paint: As recommended by panel manufacturer.
- F. Bituminous Paint: Asphalt base.
- G. Building Paper: ASTM D226; Type II, No. 30 unperforated asphalt felt.

## 2.4 FABRICATION

- A. Form sections to shape indicated on Drawings, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest practicable lengths.
- C. Panel Profile: Manufacturer's standard profile as indicated on Drawings for specified system.
- D. Fabricate corners in one continuous piece with minimum 12 inch returns.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify building framing members are ready to receive panel system.

### 3.2 INSTALLATION - BUILDING PAPER

- A. Install 1 layer building paper horizontally on walls to receive metal siding.
- B. Weather lap edges 6 inches and ends minimum 6 inches, minimum.
- C. Stagger vertical joints of each layer.
- D. Securely fasten in place.

### 3.3 INSTALLATION

- A. Protect surfaces in contact with dissimilar metals with bituminous paint. Allow to dry prior to installation.
- B. Fasten siding to structural supports; aligned, level, and plumb. Space fasteners maximum 24 inches on center either horizontally or vertically to suit application.
- C. Locate joints over supports. Lap panel ends minimum 2 inches.
- D. Install control joints where indicated.
- E. Use concealed fasteners unless otherwise approved by Architect/Engineer.
- F. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

### 3.4 ERECTION TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.

- B. Maximum Offset from Indicated Alignment Between Adjacent Members Butting or In Line: 1/16 inch.
- C. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

### 3.5 CLEANING

- A. Section 01 77 00 - Closeout Procedures: Final cleaning.
- B. Remove site cuttings from finish surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

### 3.6 SCHEDULES

- A. High side walls at new standing seam roof area. Run horizontal perpendicular to framing.
- B. Soffit all locations run perpendicular to framing.

END OF SECTION

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SECTION 07 42 43  
COMPOSITE WALL PANELS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes preformed metal panel system for walls with insulation, related flashings and accessory components.
- B. Related Sections:
  - 1. Section 05 12 00 - Structural Steel Framing: Structural steel building frame.
  - 2. Section 05 40 00 - Cold-Formed Metal Framing: Stud wall framing system.

1.2 REFERENCES

- A. Aluminum Association:
  - 1. AA ADM 1 - Aluminum Design Manual.
  - 2. AA ASM 35 - Aluminum Sheet Metal Work in Building Construction.
- B. American Society of Civil Engineers:
  - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International:
  - 1. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
  - 2. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
  - 3. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - 4. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
  - 5. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 6. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
  - 7. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
  - 8. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - 9. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
  - 10. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
  - 11. ASTM D2482 - Standard Test Method for Surface Strength of Paper (Wax Pick Method).
  - 12. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 13. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
  - 14. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
  - 15. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
  - 16. ASTM E413 - Standard Classification for Rating Sound Insulation.

- D. National Fire Protection Association:
  - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
  - 2. NFPA 285 - Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.
- E. Underwriters Laboratories Inc.:
  - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

### 1.3 SYSTEM DESCRIPTION

- A. System: Preformed and prefinished composite metal building panel system of horizontal and vertical profile; site assembled; thermoplastic compound core; with concealed fasteners.

### 1.4 PERFORMANCE REQUIREMENTS

- A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable code.
  - 1. Design Pressure: 20 lb/sq ft.
- B. Maximum Allowable Deflection of Panel: 1/180.
- C. Movement: Accommodate movement within system without damage to system, components, or deterioration of seals; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
- D. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
- E. Tolerances: Accommodate tolerances of building structural framing.
- F. Thermal Resistance of System: R of 0.86.
- G. Products: Provide continuity of thermal barrier at building enclosure elements in conjunction with adjacent thermal insulating materials.

### 1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Signed and sealed by professional engineer.
  - 1. Indicate dimensions, panel profile and layout, spans, joints, expansion joints, construction details, methods of anchorage, method and sequence of installation and interface with adjacent materials.
  - 2. Include design calculations.
- C. Product Data:
  - 1. Submit panel profile characteristics and dimensions, and structural properties.
  - 2. Submit data on assembled panel structural capabilities.
- D. Samples: Submit two samples of 12 x 12 inch in size illustrating finish color, sheen, and texture.

- E. Manufacturer's Installation Instructions: Submit special handling criteria, installation sequence, and cleaning procedures.

#### 1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with AA ASM-35.
- B. Surface Burning Characteristics:
  - 1. Composite Panels: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- C. Full Scale Fire Tests: Comply with NFPA 285, when tested in maximum thickness intended for use.

#### 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.
- C. Design metal panels under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location in State of Maryland.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- C. Store pre-finished material off ground with weather protection to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- D. Prevent contact with materials capable of causing discoloration or staining.

#### 1.9 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate Work with placement of anchors.
- C. Coordinate Work for installation of vapor retarder and air barrier seals.
- D. Coordinate Work with installation of windows and adjacent components and materials.

#### 1.10 WARRANTY

- A. Section 01 77 00 - Closeout Procedures: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for composite panels.

## PART 2 PRODUCTS

### 2.1 COMPOSITE METAL BUILDING PANELS

- A. Manufacturers:
  - 1. Laminators Incorporated, Model: Omega-Lite.
  - 2. Cap, Model: Tecpan.
  - 3. Mitsubishi Chemical America, Inc, Model: Apolic Rout and Return
  - 4. Substitutions: Section 01 60 00 - Product Requirements.

### 2.2 COMPONENTS

- A. Panel shall be smooth metal faced panels with an impact-resistant ribbed polyethylene core. Stabilized to reduce the expansion and contraction and the oil-canning of ordinary metal panels. A three layer structural-adhesive bonded construction of metal faces, and ribbed polyethylene core. The metal faces shall be 0.32 smooth aluminum with standard Kynar color finish.
  - 1. Precoated metal sheets conforming to ASTM B 209 aluminum and aluminum alloy sheet and plate. The faces will be prefinished with corrosion resistant primers and will be color coated with full strength Kynar (20) year color.
  - 2. Standard panel thickness will be 5/16" nominal.
- B. Core: Ribbed Polyethylene Core.
- C. Back: .015 aluminum.

### 2.3 ACCESSORIES

- A. Gaskets: Manufacturer's standard type suitable for use with panel system, permanently resilient; ultraviolet and ozone resistant; color to match siding.
- B. Sealants: Specified in Section 07 90 00. Manufacturer's standard type suitable for use with installation of panel system; non-staining, non-shrinking and non-sagging; ultraviolet and ozone resistant; color to match siding.
- C. Fasteners: Manufacturer's standard type to suit application; stainless steel; fastener cap same color as exterior panel.
- D. Field Touch-up Paint: As recommended by panel manufacturer.

### 2.4 FABRICATION

- A. Fabrication of primary component profiles on site is not permitted.
- B. Form sections to shape indicated on Drawings, accurate in size, square, and free from distortion or defects.
- C. Form pieces in longest practicable lengths.
- D. Form panels for flush seams.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.



- B. Verify building framing members are ready to receive panel system.

### 3.2 INSTALLATION

- A. Protect panel surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- B. Permanently fasten panel system to structural supports; aligned, level, and plumb, within specified tolerances.
- C. Locate panel joints over supports.
- D. Install control joints where indicated.
- E. Use concealed fasteners wherever possible.
- F. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

### 3.3 ERECTION TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Maximum Offset from Indicated Alignment Between Adjacent Members Butting or In Line: 1/16 inch.
- C. Maximum Variation from Plane or Location Indicated on Drawings: 1/8 inch.

### 3.4 CLEANING

- A. Section 01 77 00 - Closeout Procedures: Final cleaning.
- B. Remove site cuttings from finish surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

### 3.5 SCHEDULES

- A. Rake fascia at new addition gable roof.

END OF SECTION

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SECTION 07 54 19  
POLYVINYL-CHLORIDE (PVC-TPA) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Adhered polyvinyl-chloride (PVC) roofing system on concrete deck, including:
  - 2. Roof insulation.
- B. Related Sections:
  - 1. Section 06 11 40 - Wood Blocking and Curbing for wood nailers, curbs, and blocking.
  - 2. Section 07 21 00 - Thermal Insulation.
  - 3. Section 07 71 00 - Manufactured Roof Specialties for metal roof penetration flashings, flashings, and counterflashings.
  - 4. Section 07 90 00 - Joint Protection for joint sealants, joint fillers, and joint preparation.
  - 5. Division 22 - Plumbing for roof drains.

1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Base flashings and membrane terminations.
    - a. Indicate details meet requirements of NRCA and FMG required by this Section.
  - 2. Tapered insulation, including slopes.
  - 3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
  - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- C. Samples for Verification: For the following products:
  - 1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
  - 2. Roof insulation.
  - 3. Roof paver in each color and texture required.
  - 4. Walkway pads or rolls.
  - 5. Metal termination bars.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Contractor's Product Certificate: Submit notarized certificate, indicating products intended for Work of this Section, including product names and numbers and manufacturers' names, with statement indicating that products to be provided meet the requirements of the Contract Documents.
- B. Qualification Data: For Installer, Manufacturer, and Roofing Inspector.
  - 1. Include letter from Manufacturer written for this Project indicating approval of Installer.
- C. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
  - 1. Submit evidence of compliance with performance requirements.
  - 2. Product Compatibility: Indicate manufacturer has verified compatibility of roofing system components, including but not limited to: Roofing membrane, flashing sheets, adhesives, and sealants.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
- E. Research/Evaluation Reports: For components of membrane roofing system, from ICC-ES.
- F. Warranties: Unexecuted sample copies of special warranties.
- G. Inspection Reports: Daily reports of Roofing Inspector. Include weather conditions, description of work performed, tests performed, defective work observed, and corrective actions taken to correct defective work.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Maintenance Data: To include in maintenance manuals.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of five years' experience installing products comparable to those specified, able to communicate verbally with Contractor, Architect, and employees, and qualified by the manufacturer to install manufacturer's product and furnish warranty of type specified.
- B. Manufacturer Qualifications: UL listed and FM Approvals approved for roofing systems identical to those specified for this Project and listed in this Section, with minimum five years' experience in manufacture of comparable products in successful use in similar applications, and able to furnish warranty with provisions matching specified requirements.
  - 1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
    - a. Product data, including certified independent test data indicating compliance with requirements.
    - b. Samples of each component.
    - c. Sample submittal from similar project.
    - d. Project references: Minimum of five installations of specified products not less than five years old, with Owner and Architect contact information.
    - e. Sample warranty.

2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
  3. Approved manufacturers must meet separate requirements of Submittals Article.
- C. Roofing Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:
1. An authorized full-time technical employee of the manufacturer.
- D. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
  5. Review structural loading limitations of roof deck during and after roofing.
  6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
  7. Review governing regulations and requirements for insurance and certificates if applicable.
  8. Review temporary protection requirements for roofing system during and after installation.
  9. Review roof observation and repair procedures after roofing installation.
- E. Preinstallation Roofing Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
  5. Review structural loading limitations of roof deck during and after roofing.
  6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
  7. Review governing regulations and requirements for insurance and certificates if applicable.
  8. Review temporary protection requirements for roofing system during and after installation.
  9. Review roof observation and repair procedures after roofing installation.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.9 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1.10 WARRANTY

- A. Warranty, General: Warranties specified shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Manufacturer's Warranty: Manufacturer's standard or customized form, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
  - 1. Manufacturer's warranty includes roofing membrane, base flashings, fasteners, roofing membrane accessories roof insulation roof pavers, walkway products and other components of roofing system.
  - 2. Warranty Period: 20 year NDL (No Dollar Limit) Total System Warranty from date of Substantial Completion
- C. Manufacturer Inspection and Preventive Maintenance Requirement: By manufacturer's technical representative, to report maintenance responsibilities to Owner necessary for preservation of Owner's warranty rights. The cost of manufacturer's annual inspections and preventive maintenance is included in the Contract Sum. Inspections to occur in Years 2, 5, 10 and 15 following completion.
- D. Installer's Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section and Work of related Sections

listed in "Roof System Warranty" Paragraph above, including all components of roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

E. Extended Roof System Warranty: Warranties specified in this Section include the following components and systems specified in other sections supplied by the roofing system Manufacturer, and installed by the roofing system Installer:

1. Sheet metal flashing and trim, including roof penetration flashings.
2. Manufactured copings, roof edge, counterflashings, and reglets.
3. Roof curb, hatch, and penetration flashings.
4. Roof and parapet expansion joint assemblies.
5. Metal wall, soffit panels, and trim.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer/Product: The roof system specified in this Section is based upon Tremco, Inc. products named in other Part 2 articles. Subject to compliance with requirements, provide the named product or an approved comparable product.
- B. Source Limitations: Obtain components for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
  2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
1. Corner, Perimeter, and Field-of-Roof Uplift Pressures: As indicated on Drawings.
- D. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
1. Design Pressure: As indicated on Drawings.
- E. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a roofing system.
1. Fire/Windstorm Classification: Class 1-90.

2. Hail Resistance: MH.

- F. Flashings: Comply with requirements of Section 07 71 00. Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations of the following:
1. FM Global 1-49: Loss Prevention Data Sheet for Perimeter Flashings.
  2. FM Global 1-29: Loss Prevention Data Sheet for Above Deck Roof Components.
  3. NRCA Roofing Manual (Sixth Edition) for construction details and recommendations.
  4. SMACNA Architectural Sheet Metal Manual (Seventh Edition) for construction details.
- G. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- H. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- I. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- J. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- K. Energy Performance: Roofing system shall have an initial solar reflectance index of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

2.3 PVC MEMBRANE ROOFING

- A. Thermoplastic Tri-Polymer Alloy (TPA) Sheet: ASTM D 4434, Type IV, internally fabric reinforced, uniform, flexible TPA sheet; Energy Star qualified, CRRC listed and California Title 24 Energy Code compliant.
1. Basis of design product: Tremco, TPA Roof Membrane.
  2. Tensile Strength at 0 deg. F (-18 deg. C), minimum, ASTM D 751: 300 lbf/in (52 kN/m).
  3. Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D 751: 100 lbf (440 N).
  4. Elongation at 0 deg. F (-18 deg. C), minimum at fabric break, ASTM D 751: machine direction, 25 percent; cross machine direction, 25 percent.
  5. Minimum Thickness, ASTM D 751: 60 mils (1.5 mm), nominal.
  6. Exposed Face Color: White.
  7. Reflectance, ASTM C 1549: 86 percent.
  8. Thermal Emittance, ASTM C 1371: .86.
  9. Solar Reflectance Index (SRI), ASTM E 1980: 108
  10. Recycled Content, Minimum: 25 percent preconsumer.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet membrane.

2.4 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.



2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Plastic Foam Adhesives: 50 g/L.
    - b. Gypsum Board and Panel Adhesives: 50 g/L.
    - c. Multipurpose Construction Adhesives: 70 g/L.
    - d. Fiberglass Adhesives: 80 g/L.
    - e. Contact Adhesive: 80 g/L.
    - f. Other Adhesives: 250 g/L.
    - g. PVC Welding Compounds: 510 g/L.
    - h. Adhesive Primer for Plastic: 650 g/L.
    - i. Single-Ply Roof Membrane Sealants: 450 g/L.
    - j. Nonmembrane Roof Sealants: 300 g/L.
    - k. Sealant Primers for Nonporous Substrates: 250 g/L.
    - l. Sealant Primers for Porous Substrates: 775 g/L.
  3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Single Ply Membrane Bonding Adhesive, Low VOC: Elastomeric, low-VOC solvent-based contact-type adhesive for bonding TPA non-fleece-backed single ply membranes and flashings to substrates.
1. Basis of design product: Tremco, TPA/LV Single Ply Bonding Adhesive.
  2. Asbestos Content, EPA/600/R-93/116: None.
  3. VOC, maximum, ASTM D 3960: 200 g/L.
- C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- D. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch (25 mm wide by 1.3 mm) thick, prepunched.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- F. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.
- 2.5 ROOF INSULATION
- A. General: Preformed roof insulation boards manufactured or approved by PVC membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, approved and listed by FM Global for windstorm and fire characteristics specified, CFC- and HCFC- free, with recycled content glass-fiber mat facer on both major surfaces. CCMC listed.
1. Compressive Strength, ASTM C1621: Grade 2: 20 psi (138 kPa).

2. Conditioned Thermal Resistance at 75 deg. F (24 deg. C): 14.4 at 2.5 inches (50.8 mm) thick.

- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

## 2.6 INSULATION ACCESSORIES

- A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation] to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Two-component, solvent-free, low odor, elastomeric urethane adhesive formulated to adhere roof insulation to substrate.
  1. Basis of design product: Tremco, Low Rise Foam Insulation Adhesive.
  2. Flame Spread Index, ASTM E 84: 10.
  3. Smoke Developed Index, ASTM E 84: 30.
  4. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 0 g/L.
  5. Tensile Strength, minimum, ASTM D 412: 250 psi (1724 kPa).
  6. Peel Adhesion, minimum, ASTM D 903: 17 lbf/in (2.98 kN/m).
  7. Flexibility, 70 deg. F (39 deg. C), ASTM D 816: Pass.
- D. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

## 2.7 ASPHALT MATERIALS

- A. Asphalt Primer, Water-Based: Water-based, polymer modified, asphalt primer.
  1. Asbestos Content, EPA 600/R13/116: None.
  2. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 2 g/L.

## 2.8 WALKWAYS

- A. TPA Walkway Roll: Thermoplastic tri-polymer alloy reinforced elastomeric membrane roll, ASTM D 4434, with serrated, slip-resistant surface fabricated for heat welding to TPA tri-polymer alloy membrane surface.
  1. Roll Size: 36 inches by 60 foot (914 mm by 18.3 m).
  2. Thickness: 0.08 inch (2 mm).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
  1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.

2. Concrete Roof Deck:
  - a. Verify that minimum concrete drying period recommended by roofing manufacturer has passed.
  - b. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
  - c. Test for moisture by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling.
  - d. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
3. Verify that existing insulation and substrate is sound and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.

### 3.3 INSTALLATION, GENERAL

- A. Install roofing system in accordance with manufacturer's recommendations.
- B. Install wood cants, blocking, curbs, and nailers in accordance with requirements of Section 06 11 40.
- C. Install roofing membrane, base flashings, and component materials in compliance with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system as listed in FMG's "Approval Guide" for fire/windstorm classification indicated. Comply with recommendations in FMG Loss Prevention Data Sheet 1-49.
- D. NRCA Installation Details: Install roofing system in accordance with the following NRCA Manual Plates and NRCA recommendations; modify as required to comply with requirements of FMG references above:
  1. Base Flashing at Parapet Wall: Plates TP-1 and TP-1S.
  2. Base Flashing and Counterflashing at Parapet Wall: Plates TP-5 and TP-5S.
  3. Base Flashing and Counterflashing at Parapet Wall, Movement Joint: Plates TP-6 and TP-6S.
  4. Base and Surface-mounted Counterflashing: Plates TP-4 and TP-4S.
  5. Perimeter Edge, Raised: Plates TP-2 and TP-2S.
  6. Perimeter Edge, Embedded Edge: Plates TP-3 and TP-3S.

7. Perimeter Edge, Draining: Plates TP-3A and TP-3AS.
8. Options for Perimeter Base Securement (Roof-to-Wall and Roof-to-Curb Intersections) – Single Ply Table 7.1
9. Options for Perimeter Base Securement (Roof-to-Wall and Roof-to-Curb Intersections) – Single Ply Table 7.2
10. Scupper, Raised: Plates TP-21 and TP-21S.
11. Gutter at Draining Edge: Plates TP-22 and TP-22S.
12. Expansion Joint, with metal cover: Plates TP-7 and TP-7S and Division 7 Section “Sheet Metal Flashing and Trim.”
13. Curb Detail at Rooftop HVAC Units, Manufactured: Plates TP-12 and TP-12S.
14. Curb Detail at Rooftop HVAC Units, Job-Built, Wood: Plates TP-13 and TP-13S.
15. Curb Detail at Skylight, Roof Hatch, and Smoke Vents: Plates TP-14 and TP-14S.
16. Penetration, Structural Member: Plates TP-15 and TP-15S.
17. Penetration, Sheet Metal Enclosure: Plates TP-16 and TP-16S.
18. Penetration, Stack Flashing: Plates TP-17 and TP-17S.
19. Penetration, Plumbing Vent: Plates TP-18 and TP-18S.
20. Penetration, Plumbing Vent, Manufactured Boot: Plates TP-18A and TP-18AS.
21. Penetration, Pocket: Plates TP-19 and TP-19S.
22. Roof Drain: Plates TP-20 and TP-20S.

### 3.4 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches(150 mm) in each direction.
  1. Install insulation at average overall thickness of minimum 6 inches.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
  1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
  1. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

### 3.5 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
  1. Install sheet according to ASTM D 5036.

- B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
- E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.
- F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- G. Welded Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.
  - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
  - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
  - 3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
- H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

### 3.6 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars 6" o.c. with gasketed tape.

### 3.7 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
- B. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers.

### 3.8 FIELD QUALITY CONTROL

- A. Inspection: Contractor must have a full time inspector on site for nine hours each per every five days worked. Technical Inspector must have been employed by the manufacturer for a five year period. Technical Inspector must provide daily reports with photographs. Submittal paperwork must be provided showing the onsite technical inspector of the manufacturer has built-up roofing inspection experience of a minimum of 5 years.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.9 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 61 03  
MANUFACTURED SHEET METAL ROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Structural standing seam metal roofing.
  - 2. Metal soffit panels.
  - 3. Underlayment.
  - 4. Eave protection.
  - 5. Metal facias, flashings, and trim.
  - 6. Metal gutters and downspouts.
  - 7. Snow guards.
- B. Related Sections:
  - 1. Section 04 20 00 - Unit Masonry: Placement of flashing reglets and accessories.
  - 2. Section 05 40 00 - Cold-Formed Metal Framing: Structural framing supporting metal roofing.
  - 3. Section 07 21 20 - Board Insulation: Rigid insulation under sheet metal roofing system.
  - 4. Section 07 65 10 - Flexible Flashing Stainless Steel.

1.2 REFERENCES

- A. American Architectural Manufacturers Association:
  - 1. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
  - 2. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
  - 3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. American Iron and Steel Institute:
  - 1. AISI General - Standard for Cold-Formed Steel Framing - General Provisions.
  - 2. AISI Header - Standard for Cold-Formed Steel Framing - Header Design.
  - 3. AISI NASPEC - North American Specification for Design of Cold-Formed Steel Structural Members.
- C. American Society of Civil Engineers:
  - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- D. ASTM International:
  - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
  - 3. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - 4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 5. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.

6. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
  7. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
  8. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
  9. ASTM D2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
  10. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
  11. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
  12. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  13. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  14. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
  15. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
  16. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
  17. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- E. Federal Specification Unit:
1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
- F. National Roofing Contractors Association:
1. NRCA - The NRCA Roofing and Waterproofing Manual.
- G. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - Architectural Sheet Metal Manual.
- H. Underwriters Laboratories Inc.:
1. UL 580 - Tests for Uplift Resistance of Roof Assemblies.
- I. U.S. Environmental Protection Agency:
1. ENERGY STAR - ENERGY STAR Voluntary Labeling Program.

### 1.3 DESIGN REQUIREMENTS

- A. Roof Loads
1. Roof Live Loads: Minimum 30psf.
  2. Roof Snow Loads: As calculated in accordance with applicable 2006 IBC with 35 psf ground snow load and exposure C.
  3. Dead Loads: Actual weight of materials incorporated into Work.
- B. Wind Loads: Design and size components to withstand positive and negative wind loads, including increased loads at building corners.
1. Design Wind Load: As calculated in accordance with 90 mph basic wind speed, exposure C.
  2. Design Wind Load: To design pressure of 20 psf.
- C. Wind Uplift Resistance: UL 580; Class 90.
- D. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with 2006 IBC (International Building Code).



- E. Air Infiltration: Limit air leakage through roof assembly to 0.03 cfm/sq ft of wall area, measured at reference differential pressure across assembly of 6.24 psf as measured in accordance with ASTM E283.
- F. Water Leakage: None, when measured in accordance with ASTM E331 with test pressure of 6.24 psf.
- G. Gutter and Downspout Components: Conform to SMACNA Architectural Sheet Metal Manual and The NRCA Roofing and Waterproofing Manual for sizing components for rainfall intensity determined by storm occurrence of 1 in 10 years.

#### 1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings:
  - 1. Indicate metal roofing [and soffit] panel profiles, jointing patterns, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Product Data:
  - 1. Submit data on metal types, finishes, and characteristics.
  - 2. Submit color charts for finish selection.
- D. Samples:
  - 1. Submit two samples 16 x 16 inch in size illustrating metal roofing mounted on plywood backing illustrating typical seam, external corner, internal corner, valley, ridge, material, and finish.
  - 2. Submit two samples 16 x 16 inch in size illustrating metal finish color.
- E. Manufacturer's Installation Instructions: Submit instructions including special procedures for roofing penetrations, flashings, and perimeter conditions requiring special attention.
- F. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

#### 1.5 QUALITY ASSURANCE

- A. Calculate structural properties of framing members in accordance with AISI NASPEC.
- B. Perform Work in accordance with SMACNA Architectural Sheet Metal Manual and The NRCA Roofing and Waterproofing Manual.

#### 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum 10 years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum 5 years documented experience approved by manufacturer.
- C. Design sheet metal roofing and structural supports under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Maryland.

#### 1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials causing discoloration or staining.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate with Work of Section 04 20 00 for installing recessed flashing reglets.

1.11 WARRANTY

- A. Section 01 77 00 - Closeout Procedures: Requirements for warranties.
- B. Furnish 20 year manufacturer warranty for sheet metal roofing against structural failure, corrosion, and water penetration.
- C. Furnish 20 year manufacturer warranty for metal finish against fading, chipping, chalking, and blistering.

PART 2 PRODUCTS

2.1 MANUFACTURED SHEET METAL ROOFING

- A. Manufacturers:
  - 1. Fabral Model Prestige. (Basis of Design)
  - 2. MBCI Model Battenlok.
  - 3. Metal Fab Manufacturing, LLC Model METFAB III.
  - 4. American Buildings Company Model LOC-SEAM.
  - 5. Substitutions: Section 01 60 00 - Product Requirements.
- B. Architectural Standing Seam Metal Roofing: Factory formed metal roofing panel system with concealed fasteners.
  - 1. Panel Materials: Pre-finished galvalume steel sheet 24 gauge base metal thickness.
  - 2. Panel Width: Nominal 16 inches.
  - 3. Panel Profile: Flat.
  - 4. Seam Type: Standing seam mechanically seamed, double locked.
  - 5. Seam Height: 2 inches.
  - 6. Color: As selected.
- C. Metal Soffit Panels: Factory formed metal soffit panel system with concealed fasteners.
  - 1. Panel Materials: Pre-finished galvanized steel sheet 24 gauge base metal thickness.
  - 2. Panel Width: Nominal 12 inches.
  - 3. Panel Profile: Flat.
  - 4. Panel Depth: Nominal 1 inches.
  - 5. Panel Joint: Interlocked.

6. Color: As selected.

## 2.2 SHEET METAL MATERIALS

- A. Pre-Finished Galvalume Steel Sheet: ASTM A755/A755M coil coated.
1. Base Metal: ASTM A792/A792M; Grade 50 aluminum-zinc alloy coating.
  2. Exposed Finish: Minimum two coat fluoropolymer coating with minimum 70 percent polyvinylidene fluoride resin.
  3. Unexposed Finish: Manufacturer's standard coating.

## 2.3 ACCESSORIES

- A. Fasteners: Galvanized steel, Stainless steel. Same material and finish as roofing.
- B. Underlayment: ASTM D226; High temperature ice and water shield.
- C. Slip Sheet: Rosin sized building paper.
- D. Ice Dam Membrane: ASTM D1970; self adhering polymer modified bituminous sheet material, slip resistant surface, 40 mils thick, 36 inches wide, with strippable release paper to expose adhesive surface high temperature rated as manufactured by Tamco.
- E. Reglets: Recessed type, galvanized steel manufactured by Hickman.
- F. Snow Rails: Equal to Metal Roof Innovation Ltd. Color Guard S5 snow retention system.

## 2.4 FABRICATION

- A. Form sections shape as indicated on Drawings, accurate in size, square, and free from distortion or defects.
- B. Fabricate fascia, trim, flashing, and other metal components from same material as metal roof panels. Provide exposed metal surfaces with same finish as exposed face of metal roof panels.
- C. Fabricate cleats of same material as sheet, to interlock with sheet.
- D. Fabricate starter strips of same material as sheet, continuous, to interlock with sheet.
- E. Form pieces in longest practical lengths.
- F. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- G. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- H. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- I. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- J. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.
- K. Fabricate gutters to profile and size conforming to specified design requirements.

- L. Fabricate downspouts to rectangular size 3 x 5 diameter.
- M. Fabricate accessories in profile and size to suit gutters and downspouts.
  - 1. Anchorage Devices: In accordance with SMACNA.
  - 2. Gutter Supports: Brackets.
  - 3. Downspout Supports: Brackets.
- N. Fabricate snow guards in accordance with SMACNA Plate.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Structural Framing Substrate:
  - 1. Verify primary and secondary framing members are installed and fastened, properly aligned and sloped to valley and eaves.
  - 2. Verify damaged shop coatings are repaired with touch up paint.
- C. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets are in place, and nailing strips located.
- D. Verify roofing termination and base flashings are in place, sealed, and secure.
- E. Verify insulation is installed and ready for roof application.

### 3.2 PREPARATION

- A. Wood and Metal Deck Substrate:
  - 1. Fill knot holes and surface cracks with latex filler at areas of bonded eave protection.
  - 2. Broom clean deck surfaces under eave protection and underlayment.
- B. Back paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mil.

### 3.3 INSTALLATION - ICE DAM MEMBRANE

- A. Install ice dam membrane parallel with eave edge, flush with face of eave edge flashing with edges lapped shingle style and ends lapped and staggered between rows. Install high temperature ice and water shield over entire surface.
- B. Place single width eave protection sheet centered over valley, hips and ridges.
- C. Place single width eave protection sheet along gable, parallel to gable edge.

### 3.4 INSTALLATION - UNDERLAYMENT

- A. Apply underlayment over entire roof area in single layer fastened to substrate.
  - 1. Install underlayment laid perpendicular to slope.
  - 2. Weather lap edges 2 inches and nail in place.
  - 3. Stagger end joints minimum 24 inches.

3.5 INSTALLATION - STANDING SEAM METAL ROOFING

- A. Conform to SMACNA and NRCA details.

3.6 INSTALLATION - SOFFIT PANELS

- A. Install perimeter trim, level and aligned perpendicular with fascia.
- B. Install soffit panels to form flat, flush surface.
- C. Fit soffit panels in single length between perimeter trim. Secure panels to soffit framing substrate.
- D. Install perforated soffit panels at locations indicated on Drawings and alternating with solid panels.
- E. Adjust panels for uniform joints.

3.7 INSTALLATION - FLASHING

- A. Install reglets in accordance with Section 04 20 00.
- B. Conform to SMACNA and NRCA details.

3.8 INSTALLATION - GUTTERS AND DOWNSPOUTS

- A. Conform to SMACNA and NRCA details.

3.9 INSTALLATION - SNOW RAILS

- A. Install snow rails in accordance with manufacturer's instructions.
- B. Install snow rails in continuous line, 12 inches up slope of exterior wall.
- C. Install one additional line of rails continue along roof edge 4'-0" from gutter.

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 77 00 - Closeout Procedures: Protecting installed construction.
- B. Do not permit traffic over unprotected roof surface.

END OF SECTION

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SECTION 07 65 10  
FLEXIBLE FLASHING STAINLESS STEEL

PART 1 - GENERAL

1.1 SUMMARY

- A. Laminated stainless steel fabric flashing, non-asphaltic.
- B. Related sections:
  - 1. 04 20 00 - Unit Masonry.
  - 2. 05 40 00 - Cold Formed Metal Framing.
  - 3. 06 11 40 - Wood Blocking and Curbing.

1.2 REFERENCES

- A. Standards of the following as referenced:
  - 1. ASTM
  - 2. Brick Industry Association (BIA)
  - 3. Recycled content & Recyclability
- B. Industry standards:
  - 1. *BIA Technical Notes on Brick Construction No. 7, Water Penetration Resistance- Design and Detailing*, August 2005.
  - 2. *BIA Technical Notes on Brick Construction No. 28B, Brick Veneer/Steel Stud Walls*, August 2005.

1.3 DEFINITIONS

- A. Terms:
  - 1. Cavity wall flashing: Same as flexible flashing.
  - 2. Foundation sill flashing: Same as flexible flashing.
  - 3. Flexible flashing: Water-proof material typically used in cavity wall construction to contain and assist in the proper water drainage that may penetrate wall system veneer. Other materials may be required to constitute the system.
  - 4. Head and sill flashing: Same as flexible flashing.
  - 5. Through-wall flashing:
    - a. Generally considered the same as flexible flashing.
    - b. Rare definition referred to full width cap flashing under copings or wall caps.

1.4 SUBMITTALS

- A. Product data: Indicate material type, composition, thickness, and installation procedures.
- B. Samples: 3" by 5" flashing material.
- C. Product Quality & Environmental submittals:
  - 1. Certificates:
    - a. Indicate materials supplied or installed are asbestos free.
    - b. Indicate recycled content: 60% total recycled material; based on 60% Post Industrial Recycled Content.
  - 2. Performance Attributes
    - a. Tensile strength, 100,000 psi minimum average
    - b. Puncture Resistance, 2,500 pounds average
    - c. When tested as manufactured, product resists growth of mold pursuant to test method ASTM-D3273.

- d. Fire Rating: flame spread and smoke generation
  - 1. Rated Class A, ASTM E84
- e. Certify the use of domestic manufactured stainless steel for flashing.

## 1.5 QUALITY ASSURANCE

### A. Qualifications:

- 1. Manufacturer: Provide flashing materials by single manufacturer with not less than twenty five years of experience in manufacturing flexible flashing products.
- 2. Flashing materials must be able to withstand 400° F temperature without changing the long term performance of the flashing.

## 1.6 WARRANTY

### A. Special warranty:

- 1. Manufacturer: Warrant flexible flashing material for life of the wall.
- 2. Begin warranty at Date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURED UNITS

#### A. Flexible flashing:

- 1. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified below, and are acceptable for use, subject to compliance with specified requirements.
  - a. Product standard of quality:
    - a. York Manufacturing, Inc.; Multi-Flash SS
    - b. STS Coatings, Inc.; Gorilla Flash Stainless Fabric
    - c. Illinois Products, Inc.; IPCO Stainless Steel Fabric Flashing
    - d. TK Products, Inc.; TK TWF
    - e. Other products that meet the criteria in section 1.04 to 1.06.
- 2. Characteristics:
  - a. Type: Stainless steel core with polymer fabric laminated to one stainless steel face with non-asphalt adhesive.
  - b. Stainless steel type: 304, ASTM A167.
  - c. Fabric: polymer fabric; laminated back face of stainless steel core.
  - d. Size: Manufacturer's standard width rolls.

### 2.2 ACCESSORIES

- A. Mastic/sealant: Product standard of quality is York Manufacturing, Inc.; UniverSeal US100.
  - 1. Characteristics:
    - a. Type: One part 100% solids, solvent-free formulated silyl-terminated polyether (STPE), ASTM C920-11, Type S, Grade NS, Class 50.
- B. Outside corner and inside corner material; manufacturer's standard available units using:
  - 1. Stainless steel: 26 gauge stainless steel.
- C. End dam: Product may be folded in line with the flashing material or utilize preformed end dams by manufacturer using:
  - 1. Stainless steel: 26 gauge stainless steel



- D. Splice material: Product standard of quality is York304 SS by York. Manufacturer's standard self-adhered metal material; material matching system material or use Multi-Flash Stainless Steel 6" lap piece and polyether sealant as a splice.
- E. Termination bar: Product standard of quality is York T-96 termination bar. Manufacturer's standard 1" composite material bar or a 1" 26 gauge stainless steel termination bar with sealant lip.
- F. Weep vent protection: Product standard of quality is York's Weep Armor. Geotextile drainage fabric at least 12" in height.
- G. Repair and other materials/accessories: Manufacturer's standard.
- H. Fasteners: Domestic manufactured fastener types and sizes recommended by flashing manufacturer for intended use.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
  - 1. Install where indicated, specified, or required in accord with flashing manufacturer's written instructions and as follows.
  - 2. Extend flashing 6" minimum beyond opening. Fold flashing ends at end of openings or horizontal flashing terminations to form end dam or use pre-manufactured units made of 26 gauge stainless steel.
  - 3. Flashing width: Width required starting flush with outside face of exterior wythe, extending through cavity, rising height required to extend above lintel steel at least 2".
  - 4. Splice end joints by overlapping them 6" and seal with a compatible sealant or metal splice tape.
  - 5. Masonry back up:
    - a. Surface apply after dampproofing installation specified in Dampproofing Section in accord with manufacturer's installation instructions.
    - b. Fasten to masonry back-up surface at top by embedding in layer of sealant or use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with compatible sealant or use a termination clamp, which is embedded in the block back up wall.
  - 6. Concrete back up:
    - a. Surface apply after dampproofing installation specified in Dampproofing Section in accord with manufacturer's installation instructions.
    - b. Fasten to concrete surface at top by embedding in layer of sealant or use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with a compatible sealant.
  - 7. Stud back up with sheathing:
    - a. Fasten to stud back-up at top by embedding in layer of sealant or use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with a compatible sealant.
  - 8. Leave ready for certified compatible building felt or air barrier installation lapping flashing top installed in another Section.
  - 9. Lay flashing in continuous bead of sealant on masonry supporting steel.
  - 10. Fold ends of flashing at end of opening to form dam; seal with polyether sealant or use purchased manufacturers preformed end dams.
  - 11. Inside and outside corners: Make in industry accepted manner using corner and splice material or purchase manufactured corners from manufacturer.

12. Cover flashing within a few days of installation to protect it from damage from the different trades, the environment and falling debris. If flashing is left unprotected and it is punctured, torn, or has loose scrim you should contact the manufacturer for repair instructions.

### 3.2 SCHEDULES

#### A. Locations:

1. Exterior door heads.
2. Window heads and sills.
3. Storefront heads.
4. Horizontal control joints.
5. Changes in veneer materials, vertically.
6. Other wall openings.
7. Other locations indicated.

END OF SECTION

SECTION 07 71 00  
MANUFACTURED ROOF SPECIALTIES

PART 1 GENERAL

1.1 WORK INCLUDED

- A. Copings, Fascias, Fascia, Extruded Closure and Vents.
- B. Reglets.
- C. Gutters and Downspouts

1.2 RELATED WORK

- A. Section 07 54 19 - Polyvinyl-Chloride PVC-TPA Roofing

1.3 REFERENCES

- A. ASTM D2822 - Asphalt Roof Cement
- B. NRCA (National Roofing Contractors Association) - Roofing and Waterproofing Manual.
- C. SMACNA - Architectural Sheet Metal Manual.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- C. Product Data: Provide product data on shape of components, materials and finishes, anchor types and locations.
- D. Samples: Submit two (2) samples, 12 x 12 inches in size illustrating component shape, finish and color.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA details or as detailed within the documents.
- B. All components shall be from one manufacturing source.

1.6 WARRANTY

- A. Copings, fascia, fascia extenders, closures and reglets shall be covered by the roofing warranty specified in Section 07 54 19.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Fabral.

- B. Atlas Roofing Corp.
- C. Pac Clad
- D. Substitutions: Under provisions of the General Conditions to the Construction Contract.

## 2.2 COMPONENTS

- A. Fascias, Roof Edge, Fascia Extenders, Extruded Closures: Equal to Fabral flashing trim and edge metals 0.04 aluminum, shaped as indicated, with continuous cleat and splice plates. Include cover plates to conceal and weather seal joints and attachment flanges. Provide extruded closure plates as required and mitered, welded corners. Color shall be pre-finished Kynar 20 year finish as selected by the Architect from the manufacturer's full Kynar color range.
- B. Reglets: shall be equal to Hickman's In-wall Drive Lock and Concealed Mount Reglets with counterflashing fabricated from stainless steel. Provide factory fabricated corners and wind clips. Counterflashing shall be 5 3/4" long. Color shall be pre-finished Kynar coating as selected by the Architect.
- C. Gutters and Downspouts: Formed 22 ga. minimum, 4" x 4" gutter, 3" x 4" downspout. See drawings for profile.

## 2.3 ACCESSORIES

- A. Sealant: Roofing Manufacturer's standard type suitable for use with installation of system; non-staining, skinning, non-skinning, non-shrinking and non-sagging; ultra-violet and ozone resistant; color as selected.

## 2.4 FINISHES

- A. Provide color as selected by the Architect from the full range of Kynar formulations with 20 year manufacturer's limited warranty.

# PART 3 EXECUTION

## 3.1 INSPECTION

- A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

## 3.2 INSTALLATION

- A. Install components in accordance with manufacturer's instructions.
- B. Conform to NRCA - Waterproofing Manual drawing details.
- C. Coordinate installation of components of the section with installation of roofing membrane and base flashings.
- D. Coordinate installation of flashing flanges into reglets.

END OF SECTION

SECTION 07 90 00  
JOINT PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparing substrate surfaces.
- B. Sealant and joint backing.
- C. Security Sealants (Detention Areas).

1.2 RELATED SECTIONS

- A. Section 03 30 00 - Cast-in-Place Concrete: Sealants required in conjunction with cast-in-place concrete.
- B. Section 04 20 00 - Unit Masonry: Sealants required in conjunction with masonry.
- C. Section 08 11 00 - Steel Doors and Frames: Sealants required in conjunction with door frames.
- D. Section 08 41 00 - Aluminum Frames Storefronts.
- E. Section 08 44 13 - Glazed Aluminum Curtain Walls.
- F. Section 09 26 00 - Gypsum Board Systems.
- G. Section 09 30 00 - Tiling: Sealants required in conjunction with floor and base finish.

1.3 REFERENCES

- A. ASTM C790 - Use of Latex Sealing Compounds.
- B. ASTM C804 - Use of Solvent-Release Type Sealants.
- C. ASTM C834 - Latex Sealing Compounds.
- D. ASTM C919 - Use of Sealants in Acoustical Applications.
- E. ASTM C920 - Elastomeric Joint Sealants.
- F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- G. ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).
- H. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

1. Written certification from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated as verified through manufacturers in-house testing laboratory.
- C. Samples: Submit two samples, 1 x 4 inch in size illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

#### 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

#### 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by manufacturer.

#### 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

#### 1.8 COORDINATION

- A. Coordinate work with other trades.
- B. Coordinate the work with all sections referencing this section.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high and low temperatures, contaminants or other causes.

#### 1.10 WARRANTY

- A. Special Installer Warranty: Submit a written, labor and material warranty agreeing to repair or replace sealants which fail to provide airtight and/or watertight joints, or fail in adhesion, cohesion abrasion-resistance, stain-resistance, weather resistance, or general durability or appear to deteriorate in any other manner not clearly specified in the manufacturer

### PART 2 PRODUCTS

#### 2.1 APPROVED MANUFACTURERS

- A. Pecora
- B. Tremco

- C. Bostik
- D. Sika
- E. Substitutions shall be submitted in accordance with General Conditions to the Construction Contract.

## 2.2 SEALANTS

- A. Polyurethane Traffic Grade Sealant (Type A): ASTM C920, Two Part, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, self-leveling type; color as selected; Urexpam NR-200 manufactured by Pecora.
  - 1. Elongation Capability 25 percent
  - 2. Service Temperature Range -40 to 180 degrees F
  - 3. Shore A Hardness Range 20 to 35
- B. Polyurethane Sealant (Type B): ASTM C920, Grade NS, Class A, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type; color as selected; Dynatrol II manufactured by Pecora.
  - 1. Elongation Capability 50 percent
  - 2. Service Temperature Range -20 to 180 degrees F
  - 3. Shore A Hardness Range 20 to 35
- C. Silicone Sealant (Type C): ASTM C920, Grade NS, Class 25, Use NT; single component, fungus resistant, chemical curing, non-sagging, non-staining, non-bleeding; color as selected; 860 manufactured by Pecora.
  - 1. Elongation Capability 25 percent
  - 2. Service Temperature Range -75 to +400 degrees F
  - 3. Shore A Hardness Range 15 to 50
- D. Elastomeric Polyurethane Sealant (Type D): Two component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging, self-leveling type; color as selected; manufactured by Pecora-Dynaflex:
  - 1. Elongation Capability 175-200 percent
  - 2. Service Temperature Range -40 to 180 degrees F
  - 3. Shore A Hardness Range 55
  - 4. Tensile Strength 375-40 psi
- E. Elastomeric Silicone Sealant (Type E): One part, low modulus neutral-curing, high performance silicone sealant curing via atmospheric moisture to form a durable flexible seal; color as selected; manufactured by Pecora
  - 1. Pecora 864
    - a. Elongation Capability 900 percent
    - b. Service Temperature Range -60 to +300 degrees F
    - c. Shore A Hardness Range 25
  - 2. Pecora 890 FTS
    - a. Elongation Capability 1,00 percent
    - b. Service Temperature Range -60 to +300 degrees F
    - c. Shore A Hardness Range 20
  - 3. STI Spec Seal ES, Fire-rated Joint Sealant – Where required.

## 2.3 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backings: Provide sealant backings of material and type that are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.  
Select shape and size of joint filler in consultation with the manufacturer for proper performance in the specified condition of use in each case.
  - 1. Joint Backing: ASTM D1565; round, open cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.
  - 2. Joint Backing (For use with Type E Sealant): One of the following preformed, compressible, resilient, non-staining, non-waxing, non-extruding strips of flexible plastic foam for material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance, on the following:
    - a. HBR Backer Rod; Applied Extrusion Technologies
    - b. Soneborn Sonofoam Closed Cell Backer Rod; ChemRex, Inc.
    - c. Expand-o-Foam; Williams Products, Inc.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that substrate surfaces and joint openings are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

#### 3.2 PREPARATION

- A. Remove loose materials and foreign matter which might impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions.
- D. Protect elements surrounding the work of this section from damage or disfiguration.

#### 3.3 INSTALLATION

- A. Install sealant in accordance with manufacturer's instructions.
- B. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.



### 3.4 CLEANING

- A. Clean work under provisions of 01 77 00.
- B. Clean adjacent soiled surfaces.

### 3.5 PROTECTION OF FINISHED WORK

- A. Protect finished installation under provisions of Section 01 50 00.
- B. Protect sealants until cured.

### 3.6 SCHEDULE

**General:** The following sealants shall be installed throughout the construction where construction materials intersect or abut creating a joint which requires closure for appearance, weather, or as may be required by the Owner and Architect.

Location	Type
A. Exterior horizontal concrete paving & sidewalk expansion joints (Type A)	Two part polyurethane Traffic Grade Type II
B. Exterior vertical joints (Type B)	Two part polyurethane Type II
C. Interior vertical & horizontal joints (Type B)	Two part polyurethane Type II
D. Interior wet areas, kitchen, & toilet fixtures joints w/fungicide (Type C)	High modulus silicone
E. Detention Areas (Type D)	Elastomeric polyurethane sealant
F. Parking Garage	One Part, Low Modulus, High-Performance Silicone Sealant

END OF SECTION

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## SECTION 08 06 71

### DOOR HARDWARE SETS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. This Section references specification sections relating to commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Sliding Doors.
  - 3. Other doors to the extent indicated.
- B. Commercial door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Electromechanical and access control door hardware.
  - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
  - 1. Section 08 11 13 - Hollow Metal Doors and Frames
  - 2. Section 08 21 00 - Flush Wood Doors
  - 3. Section 08 41 00 - Aluminum Framed Storefronts
  - 4. Section 08 71 00 - Door Hardware
  - 5. Section 28 13 00 - Access Control
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. State Building Codes, Local Amendments.
- E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

##### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door

Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:
  - a. Type, style, function, size, label, hand, and finish of each door hardware item.
  - b. Manufacturer of each item.
  - c. Fastenings and other pertinent information.
  - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
  - e. Explanation of abbreviations, symbols, and codes contained in schedule.
  - f. Mounting locations for door hardware.
  - g. Door and frame sizes and materials.
4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

- C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.
- D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.
- F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum [5] years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum [3] years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum [5] years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations: Obtain each type and variety of Door Hardware specified in the Related Sections from a single source, qualified supplier unless otherwise indicated.
- E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the applicable model building code.
- F. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

#### 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

## 1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. Refer to "PART 3 – EXECUTION" for required specification sections.

## PART 3 - EXECUTION

### 3.1 DOOR HARDWARE SETS

- A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. Products listed in the Door Hardware Sets must meet the requirements described in the specification sections noted.
1. Section 08 71 00 – Door Hardware.
  2. Section 28 13 00 – Access Control.

#### **Set: 1 – Overhead Roll-up Door**

Doors: 101D, 101E

All hardware furnished by door manufacturer

#### **Set: 2 – Holding Room**

Doors: 107A

3 Hinge	T4A3786 5" x 4-1/2" NRP	US26D	MK
1 Electric Hinge (Install at second form bottom hinge)	T4A3786 5" x 4-1/2" QC-12	US26D	MK
1 ElectroLynx Harness (Install between electric hinge and junction box)	QC-C1500P		MK
1 Electrified Exit Device (Fail Secure)	ED5200 x 1259905ET x PHS x M51 x M92 x M110 x W048 x MK	630	RU
1 ElectroLynx Harness (Install between electric hinge and electrified exit device)	QC-CXXX x required length		MK

1 Closer/Stop	DC6210 A11 x M77	689	RU
1 Mounting Plate	597F58	689	RU
1 Threshold	170 A x DOW x MS & ES25		PE
1 Door Bottom Seal	321 CN x DOW		PE
2 Card Reader	Furnished and installed by security contractor		OT
1 Door Position Switch	DPS-M-BK		SU
1 Power Supply	AQD3-1R		SU
1 Wiring Diagram	WD-SYSPK		RU

Pull side card reader to be used by authorized persons to gain entry from the pull side of the opening

Pull side card reader to be used to unlock the pull side lever of the electrified exit device

Push side card reader to be used by authorized persons to exit from the push side of the opening

Push side card reader to be used to deactivate the alarm

Depressing the push bar of the electrified exit device without use of the push side card reader will activate the alarm

Push bar of the electrified exit device always free for immediate egress

### **Set: 3 – Security Gate**

Doors: 122A, 122C, 124

1 Cylinder	"As required" x PHS x MK	626	RU
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Balance of hardware furnished by door gate manufacturer

### **Set: 4 – Exterior Holding Room**

Doors: 123

1 Continuous Hinge	MCK-12HD x 84"	Clear	MK
1 Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P		MK
<i>(Install between power transfer and junction box)</i>			
1 Electrified Exit Device (Fail Secure)	ED5200 x 1259905ET x PHS x M51 x M92 x M110 x W048 x MK	630C	RU
1 ElectroLynx Harness	QC-CXXX x required length		MK
<i>(Install between power transfer and electrified exit device)</i>			
1 Closer	DC8200	689	RU
1 Wall Stop	406	US32D	RO
1 Threshold	170 A x DOW x MS & ES25		PE
1 Door Bottom Seal	345 AV x DOW		PE
1 Drip Strip	346 C x DOW + 4"		PE
2 Card Reader	Furnished and installed by security contractor		OT
1 Door Position Switch	DPS-M-BK		SU
1 Power Supply	AQD3-1R		SU
1 Wiring Diagram	WD-SYSPK		RU

Gasketing furnished by frame manufacturer

Pull side card reader to be used by authorized persons to gain entry from the pull side of the opening

Pull side card reader to be used to unlock the pull side lever of the electrified exit device

Exterior side card reader to be used by authorized persons to exit from the exterior side of the opening

Exterior side card reader to be used to deactivate the alarm

Depressing the push bar of the electrified exit device without use of the exterior side card reader will activate the alarm

Push bar of the electrified exit device always free for immediate egress

**Set: 5** – Holding Room

Doors: 124A

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lockset	ML2055 125U x PHS x MK	626	RU
1 Closer/Holder	DC6200 A1	689	RU
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608		RO

**Set: 6** – Exterior Holding Room

Doors: 124B

1 Continuous Hinge	MCK-12HD x 95"	Clear	MK
1 Power Transfer	EL-CEPT		SU
1 ElectroLynx Harness	QC-C1500P		MK
<i>(Install between power transfer and junction box)</i>			
1 Electrified Exit Device (Fail Secure)	ED5200 x 1259905ET x PHS x M51 x M92 x M110 x W048 x MK	630C	RU
1 ElectroLynx Harness	QC-CXXX x required length		MK
<i>(Install between power transfer and electrified exit device)</i>			
1 Closer	DC8210 A3 x M77	689	RU
1 Mounting Plate	754F25	689	RU
1 Overhead Stop	1-X36 x 90 deg	652	RF
1 Threshold	170 A x DOW x MS & ES25		PE
1 Door Bottom Seal	345 AV x DOW		PE
1 Drip Strip	346 C x DOW + 4"		PE
2 Card Reader	Furnished and installed by security contractor		OT
1 Door Position Switch	DPS-M-BK		SU
1 Power Supply	AQD3-1R		SU
1 Wiring Diagram	WD-SYSPK		RU

Gasketing furnished by frame manufacturer

Exterior side card reader to be used by authorized persons to gain entry from the exterior side of the opening

Exterior side card reader to be used to unlock the exterior side lever of the electrified exit device

Push side card reader to be used by authorized persons to exit from the push side of the opening

Push side card reader to be used to deactivate the alarm

Depressing the push bar of the electrified exit device without use of the push side card reader will activate the alarm

Push bar of the electrified exit device always free for immediate egress



**Set: 7 – Group Toilet**

Doors: 125, 126

4 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Push Plate	70C 4 x 16	US32D	RO
1 Pull Plate	110 x 70C 4 x 16	US32D	RO
1 Closer	DC5230	689	RU
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" x 1" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608		RO

**Set: 8 – Custodian**

Doors: 126A

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lockset	ML2057 125U x PHS x MK	626	RU
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" x 1" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608		RO

**Set: 9 – Café**

Doors: 127

4 Hinge	T4A3786 5" x 4-1/2" NRP	US26D	MK
1 Storeroom Lockset	ML2057 125U x PHS x MK	626	RU
1 Closer/Stop	DC6210 A11	689	RU
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" x 1" LDW 4BE CSK	US32D	RO
3 Silencer	608		RO

**Set: 10 – Office**

Doors: 128, 133

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Office Lockset	ML2051 125U x PHS x MK	626	RU
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608		RO

**Set: 11 – Conference Room**

Doors: 129

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lockset	ML2055 125U x PHS x MK	626	RU
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO

1 Wall Stop	406	US32D	RO
3 Silencer	608		RO

**Set: 12 – Utility**

Doors: 130

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge <i>(Install at second from bottom hinge)</i>	TA2714 4-1/2" x 4-1/2" PoE	US26D	MK
1 ElectroLynx Harness <i>(Install between electric hinge and junction box)</i>	PoE-C1500P		MK
1 Mortar Box	MG-16	US2C	MK
1 Access Control Lockset	IN220-ML20234 125U x PHS x IPS x MB x MK (Refer to Section 281300)	626	RU
1 ElectroLynx Harness <i>(Install between electric hinge and access control lockset)</i>	PoE-CXXX x required length		MK
1 Closer	DC6200	689	RU
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608		RO
1 Wiring Diagram	WD-SYSPK		RU

Door mounted reader to be used by authorized persons to gain entry from the push side of the opening

Door mounted reader to be used to unlock the push side lever of the access control lockset

Pull side lever of the access control lockset always free for immediate egress

**Set: 13 – Storage**

Doors: 131

4 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lockset	ML2057 125U x PHS x MK	626	RU
1 Closer	DC6200	689	RU
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
1 Gasketing (Set)	S88 BL x DOW x DOH		PE

**Set: 14 – Office**

Doors: 134

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Electric Hinge <i>(Install at second from bottom hinge)</i>	TA2714 4-1/2" x 4-1/2" PoE	US26D	MK
1 ElectroLynx Harness <i>(Install between electric hinge and junction box)</i>	PoE-C1500P		MK
1 Mortar Box	MG-16	US2C	MK
1 Access Control Lockset	IN220-ML20234 125U x PHS x IPS x MB x MK (Refer to Section 281300)	626	RU
1 ElectroLynx Harness <i>(Install between electric hinge and access control lockset)</i>	PoE-CXXX x required length		MK

1 Closer/Holder	DC6200 A1	689	RU
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608		RO
1 Wiring Diagram	WD-SYSPK		RU

Door mounted reader to be used by authorized persons to gain entry from the push side of the opening  
Door mounted reader to be used to unlock the push side lever of the access control lockset  
Pull side lever of the access control lockset always free for immediate egress

### **Set: 15 – Exterior Corridor**

Doors: 138

1 Continuous Hinge	MCK-12HD x 83"	Clear	MK
1 Exit Device	ED5200 x K157ET x PHS x M51 x M110 x MK	630	RU
1 Pull	RM201 x Type 12HD mounting	US32D	RO
1 Closer	DC8210 A3 x M77	689	RU
1 Mounting Plate	754F25	689	RU
1 Overhead Stop	1-X36 x 90 deg	652	RF
1 Threshold	170 A x DOW x MS & ES25		PE
1 Door Bottom Seal	345 AV x DOW		PE
1 Drip Strip	346 C x DOW + 4"		PE
1 Door Position Switch	DPS-M-BK		SU

Gasketing furnished by frame manufacturer

### **Set: 16 – Vestibule**

Doors: 143A

4 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lockset	ML2057 125U x PHS x MK	626	RU
1 Closer	DC6200	689	RU
1 Wall Stop	406	US32D	RO

### **Set: 17 – Existing Door**

Doors: E101A, E115, E137A

1 Access Control Lockset	IN120-ML20134 125U x PHS x IPS x MB x MK (Refer to Section 281300)	626	RU
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Existing door and frame to remain  
Balance of hardware existing to remain  
Door mounted reader to be used by authorized persons to gain entry from the push side of the opening  
Door mounted reader to be used to unlock the push side lever of the access control lockset  
Pull side lever of the access control lockset always free for immediate egress  
The general contractor shall verify that all new hardware will work with existing door and frame conditions

**Set: 18 – Existing Door**

Doors: E117B, E118A, E119A, E120A, E121A, E143B

1	Electric Strike	1500C x 2004 x 24VDC	630	HS
1	ElectroLynx Harness	QC-C1500P		MK
	<i>(Install between electric strike and junction box)</i>			
1	Card Reader	Furnished and installed by security contractor		OT
1	Door Position Switch	DPS-W-BK		SU
1	Power Supply	AQD3-1R		SU
1	Wiring Diagram	WD-SYSPK		RU

Existing door and frame to remain

Balance of hardware existing to remain

Card reader to be used by authorized persons to gain entry from the push side of the opening

Card reader to be used to activate the electric strike

The general contractor shall verify that all new hardware will work with existing door and frame conditions

**Set: MISC – Miscellaneous**

Doors:

1	Lock Configuration Tool	WFCD1 (Refer to Section 281300)	RU
1	Lock Management Tool	WFCD1 (Refer to Section 281300)	RU
1	Credential (Lot)	50 each (Refer to Section 281300)	RU

END OF SECTION

SECTION 08 11 00  
STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes steel doors, panels and frames; non-rated and fire rated, and interior borrowed light frames.

1.2 RELATED SECTIONS

- A. Section 08 21 00 – Flush Wood Doors
- B. Section 08 71 00 – Door Hardware
- C. Section 08 80 00 – Glazing
- D. Section 09 90 00 – Painting

1.3 SUBMITTALS

- A. Shop Drawings: Indicate door and frame elevations, internal reinforcement, cut-outs for glazing, louvers, jamb and door selections and finishes.
- B. Product Data: Submit door and frame configurations, location of cut-outs for hardware reinforcement.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
  - 1. ANSI 250.8 - Recommended Specifications for Standard Steel Doors and Frames.
  - 2. DHI - Door Hardware Institute - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- B. Fire Rated Door and Panel Construction: Conform to NFPA 252.
- C. Fire Rated Stair Doors: Rate of rise of 450 degrees F across door thickness.
- D. Installed Fire Rated Door and Panel Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.
- E. Attach label from agency approved by authority having jurisdiction to identify each fire rated door.
  - 1. Indicate temperature rise rating for stair doors.
- F. Surface Burning Characteristics:
  - 1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84 and NFPA 255.
- G. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation material.

## PART 2 PRODUCTS

### 2.1 STEEL DOORS AND FRAMES

- A. Manufacturers:
  - 1. Amweld Building Products, Inc.
  - 2. Ceco Door Products.
  - 3. Pioneer Industries.
  - 4. Republic Builders Products.
  - 5. Steelcraft.
  - 6. Curries.
  - 7. Substitutions: Permitted in accordance with Section 01 60 00.
- B. Product Description: Standard shop fabricated steel doors, door panels, and frames; fire rated and non-rated types; flush face or stile and rail design, and door louvers.

### 2.2 COMPONENTS

- A. Exterior Doors (Insulated): SDI 108, 1-3/4 inch thick.
  - 1. Level 3 - Extra heavy Duty, Model 2, seamless design. - galvanized.
- B. Interior Doors (Non-Rated): SDI 108, 1-3/4 inch thick.
  - 1. Level 3 - Extra heavy Duty, Model 2, seamless design.
- C. Interior Doors (Fire Rated): SD I 108, 1-3/4 inch thick.
  - 1. Level 3 - Extra heavy Duty, Model 2, seamless design.
- D. Exterior Frames:
  - 1. Level 3 for Door Models 2 nominal 16 gage/0.053 inch thick material, base metal thickness. - galvanized
- E. Interior Frames:
  - 1. Level 3 for Door Models 2, nominal 16 gage/0.053 inch thick material, base metal thickness.
- F. Door Core: Polystyrene foam and steel channel grid.
- G. End Closure: Channel, 0.04 inch thick, inverted.
- H. Thermal Insulated Door: Total insulation R-Value of 4, measured in accordance with ASTM C1363.
- I. Sound Rated Door: STC of 32, measured in accordance with ASTM E413.

### 2.3 ACCESSORIES

- A. Door Louvers: Roll formed material; Inverted Y blade, sight proof; prime painted.
- B. Silencers: Resilient vinyl fitted into drilled hole.
- C. Removable Stops: Rolled steel channel shape.
- D. Astragals for Double Doors: Steel, T shaped, specifically for double doors.
- E. Bituminous Coating: Fibered asphalt emulsion.

- F. Primer: ANSI A250.10 rust inhibitive type.
- G. Weatherstripping: Specified in Section 08 71 00.

## 2.4 FABRICATION

- A. Fabricate doors and frames with hardware reinforcement welded in place. Protect frame hardware preparations with mortar guard boxes.
- B. Attach astragal to one leaf of pairs of doors.
- C. Fabricate frames as face welded units.
- D. Fabricate frames to suit masonry wall coursing with head member as detailed.
- E. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- F. Prepare interior frames for silencers and install.
- G. Frame Mullions for Double Doors: Removable type, with profile matching jambs.
- H. Frame Transom Bars: Fixed type, with profile matching jamb and head.
- I. Attach fire rating label to each fire rated door and frame.

## 2.5 SHOP FINISHING

- A. Steel Sheet: Galvanized to ASTM A653/A653M A60.
- B. Primer: Baked.
- C. Coat inside of frame profile with bituminous coating.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify opening sizes and tolerances are acceptable.

### 3.2 INSTALLATION

- A. Install doors and frames in accordance with ANSI A250.8.
- B. Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00.
- C. Coordinate door frames with masonry, gypsum board wall construction for frame anchor placement.
- D. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.
- E. Install door louvers plumb and level.

- F. Coordinate installation of glass and glazing specified in Section 08 80 00.
- G. Adjust door for smooth and balanced door movement.
- H. Tolerances:
  - 1. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

END OF SECTION



## SECTION 08 11 13

### HOLLOW METAL DOORS AND FRAMES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Standard and custom hollow metal doors and frames.
  - 2. Steel sidelight, borrowed lite and transom frames.
- B. Related Sections:
  - 1. Section 04 20 00 - Unit Masonry for embedding anchors for hollow metal work into masonry construction.
  - 2. Section 08 21 00 - Flush Wood Doors
  - 3. Section 08 71 00 - Door Hardware
  - 4. Section 08 80 00 - Glazing for glass view panels in hollow metal doors.
  - 5. Section 09 90 00 - Painting for field painting hollow metal doors and frames.
  - 6. Section 28 13 00 - Access Control for access control devices installed at door openings and provided as part of a security access control system.
- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
  - 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
  - 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
  - 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
  - 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
  - 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
  - 7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
  - 9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
  - 10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
  - 11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
  - 12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
  - 13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.

14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
  1. Elevations of each door design.
  2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  3. Locations of reinforcement and preparations for hardware.
  4. Details of anchorages, joints, field splices, and connections.
  5. Details of accessories.
  6. Details of moldings, removable stops, and glazing.
  7. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
  1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
  1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
  2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
  3. Smoke Control Door Assemblies: Comply with NFPA 105.
    - a. Smoke "S" Label: Doors to bear "S" label and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
  - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

#### 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

#### 1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective frames.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
  - 1. CECO Door Products (CE).

2. Curries Company (CU).
3. Pioneer Industries (PI).

## 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

## 2.3 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
  1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
  2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
  3. Manufacturers Basis of Design:
    - a. Curries Company (CU) - M Series.
- C. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

## 2.4 FRAME ANCHORS

- A. Jamb Anchors:
  1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
  2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

## 2.5 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

## 2.6 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

## 2.7 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Frames:
  - 1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
    - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
  - 3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
  - 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
  - 6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
  - 7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
  - 8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  - 9. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Two anchors per jamb up to 60 inches high.
      - 2) Three anchors per jamb from 60 to 90 inches high.
      - 3) Four anchors per jamb from 90 to 120 inches high.
      - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches high.
      - 2) Four anchors per jamb from 60 to 90 inches high.
      - 3) Five anchors per jamb from 90 to 96 inches high.

- 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
  - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
- D. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  2. Reinforce frames to receive non-template, mortised and surface mounted door hardware.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

## 2.8 STEEL FINISHES

- A. Prime Finishes: Frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

- D. Drill and tap frames to receive non-template, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
  - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
  - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
  - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

### 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION

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SECTION 08 21 00  
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Solid-core doors and transom panels with wood-veneer faces.
  - 2. Factory finishing flush wood doors.
  - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Sections:
  - 1. Section 08 80 00 - Glazing for glass view panels in flush wood doors.
  - 2. Section 09 90 00 - Painting for field finishing doors.

1.2 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
  - 1. Indicate dimensions and locations of mortises and holes for hardware.
  - 2. Indicate dimensions and locations of cutouts.
  - 3. Indicate requirements for veneer matching.
  - 4. Indicate doors to be factory finished and finish requirements.
  - 5. Indicate fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors from single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
  - 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
  - 1. Temperature-Rise Limit: Where indicated, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- D. Preinstallation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.

- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

## 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Algoma Hardwoods, Inc.
  - 2. Eggers Industries.
  - 3. Mohawk Flush Doors, Inc.; a Masonite company.

### 2.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
- B. WDMA I.S.1-A Performance Grade: Heavy Duty.
- C. WDMA I.S.1-A Performance Grade:
  - 1. Heavy Duty unless otherwise indicated.
- D. Particleboard-Core Doors:
  - 1. Particleboard: ANSI A208.1, Grade LD-1, made with binder containing no urea-formaldehyde resin.
  - 2. Blocking: Provide wood blocking in particleboard-core doors as follows:
    - a. 5-inch top-rail blocking, in doors indicated to have closers.
    - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
    - c. 5-inch midrail blocking, in doors indicated to have exit devices.
  - 3. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- E. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

F. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
  - a. 5-inch top-rail blocking.
  - b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
  - c. 5-inch midrail blocking, in doors indicated to have armor plates.
  - d. 4-1/2-by-10-inch lock blocks and 5-inch midrail blocking, in doors indicated to have exit devices.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA faces.
2. Species: Red oak.
3. Cut: Plain sliced .
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Pair and Set Match: Provide for doors hung in same opening.
7. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
8. Transom Match: Continuous match.
9. Exposed Vertical Edges: Same species as faces or a compatible species] [Same species as faces.
10. Core: Particleboard.
11. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.
12. Construction: Seven plies, either bonded or nonbonded construction.
13. WDMA I.S.1-A Performance Grade: Heavy Duty.

2.4 LOUVERS AND LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
1. Wood Species: Same species as door faces.
  2. Profile: Flush rectangular beads.
  3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
- C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated.

## 2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
  - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  - 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
  - 1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. Openings: Cut and trim openings through doors in factory.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 - Glazing.
  - 3. Louvers: Factory install louvers in prepared openings.

## 2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory.
- C. Finish doors at factory that are indicated to receive transparent finish.
- D. Transparent Finish:
  - 1. Grade: Custom.
  - 2. Finish: AWI conversion varnish system.
  - 3. Staining: As selected by Architect from manufacturer's full range.
  - 4. Effect: Open-grain finish.
  - 5. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
  - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Hardware: For installation, see Section 08 71 00 – Door Hardware.
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
  - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

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SECTION 08 31 00  
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes fire resistive rated and non-rated access doors and panels with frames.
  - 1. Provide for access to controls, valves, traps, dampers, cleanouts, and similar items requiring operation behind inaccessible finished surfaces.
  - 2. Coordinate exact locations with various trades to assure proper placement of access doors and panels.
- B. Related Sections:
  - 1. Section 09 90 00 - Painting: Field paint finish.
  - 2. Division 23 – Heating, Ventilating and Air Conditioning (HVAC).

1.2 REFERENCES

- A. ASTM International:
  - 1. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- B. Intertek Testing Services (Warnock Hersey Listed):
  - 1. WH - Certification Listings.
- C. National Fire Protection Association:
  - 1. NFPA 80 - Standard for Fire Doors, Fire Windows.
- D. Underwriters Laboratories Inc.:
  - 1. UL - Building Materials Directory.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate exact position of access door units.
- C. Product Data: Submit literature indicating sizes, types, finishes, hardware, scheduled locations, fire resistance listings, and details of adjoining Work.
- D. Samples: Submit two 12 x 12 inch in size illustrating frame configuration and anchors.
- E. Manufacturer's Installation Instructions: Submit installation requirements and rough-in dimensions.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 77 00 - Closeout Procedures.
- B. Section 01 78 20 – Operation and Maintenance Data.

## 1.5 QUALITY ASSURANCE

- A. Fire Resistance Ratings: Where indicated as fire rated provide assemblies from manufacturers listed in UL Directory or Intertek Testing Services (Warnock Hersey Listed) Directory.
- B. Fire Rated Horizontal Access Doors: Rating as indicated on Drawings.
  - 1. Tested Rating: Determined in accordance with ASTM E119.
- C. Attach label from agency approved by authority having jurisdiction to identify each fire rated access door.

## 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified with minimum three years documented experience, and with service facilities within 100 miles of Project.

## 1.7 COORDINATION

- A. Section 01 31 00 – Project Management and Coordination: Requirements for coordination.
- B. Coordinate Work with work requiring controls, valves, traps, dampers, cleanouts, and similar items requiring operation being located behind finished surfaces.

# PART 2 PRODUCTS

## 2.1 ACCESS DOORS AND PANELS

- A. Manufacturers:
  - 1. J. L. Industries.
  - 2. Karp Associates, Inc.
  - 3. Nystrom Products Co.
  - 4. Milcor LTD, Partnership.
  - 5. Substitutions: Section 01 60 00 - Product Requirements.
- B. Flush Framed Access Doors (Type 1): Frames and nominal 1 inch wide exposed flanges of 16 gage steel and door panels of 14 gage steel.
- C. Gypsum Board Access Doors (Type 2): Frames and nominal 1 inch wide flanges of 16 gage steel and door panels of 14 gage steel. Design flanges to be concealed by gypsum board joint finishing compound specified in Section 09 26 00.
- D. Recessed Wall Access Doors (Type 4): Frames and nominal 1 inch wide flanges of 14 gage steel and door panels of 16 gage steel. Door recessed ½” with factory installed ½” gypsum board. Flanges to be concealed by gypsum board joint finishing compound specified in Section 09 26 00.
- E. Fire Rated Access Doors (Type 5): Frames and nominal 1 inch wide exposed flanges of minimum 16 gage steel and door panels of 20 gage steel. Provide self closing and latching doors with keyed lock to match cylinders specified in Section 08 71 00.

## 2.2 FABRICATION

- A. Fabricate units of continuous welded construction; weld, fill, and grind joints to assure flush and square unit.



- B. Wall and Ceiling Access Door and Panel Hardware:
  - 1. Hinge: Standard continuous or concealed spring pin type, 175 degree steel hinges.
  - 2. Lock: Self-latching lock. Screw driver slot for quarter turn cam lock.
- C. Floor Hatch Hardware:
  - 1. Hinge: 175 degree steel continuous hinge with removable pin concealed constant force closure spring type.
  - 2. Lock: Self-latching lock. Screw driver slot for quarter turn cam lock. Cylinder lock with latch, two keys for each unit.
- D. Size Variations: Obtain acceptance of manufacturer's standard size units which vary slightly from sizes shown or scheduled.

### 2.3 SHOP FINISHING

- A. Base Metal Protection: Prime coat units with baked on primer.
- B. Finish: One coat baked enamel, color as selected.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 31 00 - Project Management and Coordination: Coordination and project conditions.
- B. Verify rough openings for access doors and panels are correctly sized and located.

### 3.2 INSTALLATION

- A. Secure frames rigidly in place, plumb and level in opening, with plane of door and panel face aligned with adjacent finished surfaces.
  - 1. Set concealed frame type units flush with adjacent finished surfaces.
- B. Position unit to provide convenient access to concealed work requiring access.
- C. Install fire rated units in accordance with NFPA 80 and requirements for fire listing.

### 3.3 SCHEDULES

- A. Gypsum Board Ceilings: Type 2, 24 x 24 inch size, screwdriver slot lock, primed and one coat baked enamel "White".
- B. Gypsum Board Walls: Type 4, 36x 24 inch size, cylinder lock. Paint to match adjacent finish.
- C. Washroom Walls Above Urinal Valves: Type 1, 12 x 12 inch size, cylinder lock, primed and two coat baked enamel to match ceramic tile color.
- D. Fire Rated Masonry Walls: Type 5, 12 x 12 inch size, cylinder lock, primed.

END OF SECTION

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SECTION 08 33 00  
STEEL WEAVE® METAL MESH GRILLE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Electric operated overhead rolling grilles.
- B. Related Sections:
  - 1. Section 05 50 00 - Metal Fabrications. Door opening jamb and head members.
  - 2. Section 08 31 00 - Access Doors and Panels. Access doors.
  - 3. Section 08 71 00 - Door Hardware. Masterkeyed cylinders.
  - 4. Division 26: Electrical wiring and conduit, fuses, disconnect switches, connection of operator to power supply, and installation of control station and wiring.
- C. Products That May Be Supplied, But Are Not Installed Under This Section:
  - 1. Control station.

1.2 SYSTEM DESCRIPTION

- A. Design Requirements:
  - 1. Cycle Life:
    - a. Design grilles of standard construction for normal use of up to 10 cycles per day maximum, and an overall maximum of 50,000 operating cycles for the life of the grille.

1.3 SUBMITTALS

- A. Reference Section 01 33 00 - Submittal Procedures; submit the following items:
  - 1. Product Data.
  - 2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
  - 3. Quality Assurance/Control Submittals:
    - a. Provide proof of manufacturer ISO 9001:2008 registration.
    - b. Provide proof of manufacturer and installer qualifications - see 1.3 below.
    - c. Provide manufacturer's installation instructions.
  - 4. Closeout Submittals:
    - a. Operation and Maintenance Manual.
    - b. Certificate stating that installed materials comply with this specification.

1.4 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Manufacturer Qualifications: ISO 9001:2008 registered and a minimum of five years of experience in producing grilles of the type specified.
  - 2. Installer Qualifications: Manufacturer's approval.

1.5 DELIVERY STORAGE AND HANDLING

- A. Reference Section 01 60 00 - Product Requirements.
- B. Follow manufacturer's instructions.

## 1.6 WARRANTY

- A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.
- B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products.

## PART 2 PRODUCTS

### 2.1 MANUFACTURER

- A. Cornell: 24 Elmwood Ave. Mountain Top, PA 18707. Telephone: (800) 233-8366  
Contact: Chris Stover – ADS Department, Ext 4072 [chris.stover@cornellcooksn.com](mailto:chris.stover@cornellcooksn.com)
- B. Alternates:
  - 1. Cookson
  - 2. Clopay
- C. Substitutions: Equal or better

### 2.2 PRODUCT INFORMATION

- A. Model: EAG10C

### 2.3 MATERIALS

- A. Curtain:
  - 1. Tigris Curtain
    - a. Woven Stainless Steel Mesh shall be manufactured using drawn stainless steel wire and stainless steel rods. The warp wire is 3x.075" T316L stainless steel; and the weft element is .115" T316L stainless steel.
    - b. Product Data: The fabric shall be 100% AISI type 316L Electro polishing quality stainless steel for exterior application.
    - c. Open area to be 64%.
- B. Bottom Bar:
  - 1. Configuration:
    - a. Stainless Steel angles forming tubular shape
  - 2. Finish:
    - a. 316 Stainless Steel Curtain with 304 Stainless Steel Bottom Bar: Factory polished.
- C. Guides, Tube Mounted:
  - 1. Aluminum: Heavy duty extruded aluminum one piece guide with santoprene wear strips. Provide steel tubes, floor saddles and hardware as recommended by manufacturer to support grille.
    - a. Finish, Aluminum Guide Components: Clear anodized
    - b. Finish, Steel Mounting Tubes: Unpainted.
- D. Counterbalance Shaft Assembly:
  - 1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.

2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of grille to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.
- E. Brackets: Fabricate from minimum 3/16 inch (4.76 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
  1. Finish: Zirconium treatment followed by a black baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.
- F. Hood & Fascia: 20 GA stainless steel 3 sided hood with return on bottom flange to allow bottom bar to align flush with bottom of hood when door in opened position. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.
  1. Finish: Stainless Steel hood.

## 2.4 OPERATION

- A. Motor – Standard Use – Model MG (Industrial Duty Gear Head) Operator: The operator must not extend above or below the door coil when mounted front-of-coil. Rated for a maximum of 20 cycles per hour (not to be used for consecutive hours) cULus listed (to comply with UL requirements in The United States and Canada), Totally Enclosed Non Ventilated gear head operator rated 1/3 hp as recommended by door manufacture for size and type of door, 115 Volts, 1 Phase. Provide complete with electric motor and factory pre-wired motor control terminals, maintenance free solenoid actuated brake, emergency manual chain hoist and control station. Motor shall be high starting torque, industrial type, protected against overload with an auto-reset thermal sensing device. Primary speed reduction shall be heavy-duty, lubricated gears with mechanical braking to hold the door in any position. Operator shall be equipped with an emergency manual chain hoist assembly that safely cuts operator power when engaged. A disconnect chain shall not be required to engage or release the manual chain hoist. Operator drive and door driven sprockets shall be provided with #50 roller chain. Provide an integral Motor Mounted Interlock system to prevent damage to door and operator when mechanical door locking devices are provided. Operator shall be capable of driving the door at a speed of 8 to 9 inches per second (20 to 23 cm/sec). Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door. The electrical contractor shall mount the control station and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.
- B. Control Stations:
  1. Flush mounted: "Open/Close" key switch with "Best" core cylinder; NEMA 1B
- C. Control Operation:
  1. Constant Pressure to Close:

## 2.5 ACCESSORIES

- A. Locking:
  1. Master keyable turn handle with cylinder operable from coil side of bottom bar.
- B. Interior Aesthetic Covers:
  1. Operator and Bracket Mechanism Cover: Minimum 20 gauge stainless steel sheet metal cover to enclose exposed moving operating components at coil area of unit, tab & slotted design. Finish matching hood.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
- C. Commencement of work by installer is acceptance of substrate.

### 3.2 INSTALLATION

- A. General: Install grille and operating equipment with necessary hardware, anchors, inserts, hangers and supports.
- B. Follow manufacturer's installation instructions.

### 3.3 ADJUSTING

- A. Following completion of installation, including related work by others, lubricate, test, and adjust grilles for ease of operation, free from warp, twist, or distortion.

### 3.4 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

### 3.5 DEMONSTRATION

- A. Demonstrate proper operation to Owner's Representative.
- B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

SECTION 08 33 36  
OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Overhead coiling insulated doors.

1.2 RELATED SECTIONS

- A. Section 05 50 00 - Metal Fabrications: Support framing and framed opening.
- B. Section 26 05 33 - Raceway and Boxes for Electrical: Conduit from electric circuit to door operator and from door operator to control station.

1.3 REFERENCES

- A. ANSI/DASMA 108 - American National Standards Institute Standard Method for Testing Sectional Garage Doors and Rolling Doors: Determination of Structural Performance Under Uniform Static Air Pressure Difference.
- B. NFRC 102 - Test Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.
- C. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.
- D. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- E. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- F. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- G. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- H. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- J. NEMA MG 1 - Motors and Generators.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Overhead coiling insulated doors:
  - 1. Wind Loads: Design door assembly to withstand wind/suction load of 20 psf (958 Pa) without damage to door or assembly components in conformance with ASTM E 330.

2. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.
- B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  1. Preparation instructions and recommendations.
  2. Storage and handling requirements and recommendations.
  3. Details of construction and fabrication.
  4. Installation instructions.
- C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.
- B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  1. Finish areas designated by Architect.
  2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
  3. Refinish mock-up area as required to produce acceptable work.



1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
- C. Store materials in a dry, warm, ventilated weathertight location.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 COORDINATION

- A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.10 WARRANTY

- A. Warranty: Manufacturer's limited door and operator system, except the counterbalance spring and finish, to be free from defects in materials and workmanship for 3 years or 20,000 cycles, whichever occurs first.
- B. Warranty: Manufacturer's limited door system warranty for 2 years for all parts and components.
- C. PowderGuard Finish
  - 1. PowderGuard Zinc Base Coat applied to guides, bottom bar, headplates plus PowderGuard Premium applied to curtain and top coat for guides, bottom bar, headplates: Manufacturer's limited Zinc Finish warranty for 4 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: [www.overheaddoor.com](http://www.overheaddoor.com). E-mail: [info@overheaddoor.com](mailto:info@overheaddoor.com).
- B. Substitutions: Equal products when approved prior to bid.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.2 INSULATED OVERHEAD COILING SERVICE DOORS

- A. Overhead Coiling Stormtite Insulated Service Doors: Overhead Door Corporation Model 625.

1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
  - a. Flat profile type F-265i for doors up to 40 feet (12.19 m) wide.
  - b. Front slat fabricated of:
    - 1) 20 gauge galvanized steel.
  - c. Back slat fabricated of:
    - 1) 22 gauge galvanized steel.
  - d. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation.
    - 1) R-Value: 7.7, U-Value: 0.13.
    - 2) Sound Rating: STC-21.
2. Performance:
  - a. Through Curtain Sound Rating: Sound Rating: STC-28 (STC-30+ with HZ noise generator) as per ASTM E 90.
  - b. Installed System Sound Rating: STC-21 as per ASTM E 90.
  - c. U-factor: 0.91 NFRC test report, maximum U-factor of no higher than 1.00.
  - d. Air Infiltration: Meets ASHRAE 90.1 & IECC 2012/2015 C402.4.3 Air leakage <1.00 cfm/ft<sup>2</sup>.
3. Weatherseals:
  - a. Vinyl bottom seal, exterior guide and internal hood seals.
  - b. Interior guide weatherseal.
  - c. Lintel weatherseal.
  - d. Air Infiltration Package, IECC 2012/2015 listed; product to meet C402.4.3 2012 Air leakage <1.00 cfm/ft<sup>2</sup>.
    - 1) Air infiltration perimeter seal package includes: guide cover, guide cap, dual brush exterior guide seal, 4 inch finned lintel brush seal and vinyl bottom seal.
4. Guides: Three structural steel angles.
5. Brackets:
  - a. Galvanized steel to support counterbalance, curtain and hood.
6. Finish; Bottom Bar, Guides, Headplate and Brackets:
  - a. Finish: Black powdercoat finish.
  - b. Finish: PowderGuard Zinc base coat, gray with PowderGuard Premium powder coat color as selected by the Architect.
7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
8. Hood: Provide with internal hood baffle weatherseal.
  - a. 24 gauge galvanized steel with intermediate supports as required.
9. Manual Operation:
  - a. Chain hoist.
10. Electric Motor Operation: Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.
  - a. Sensing Edge Protection:
    - 1) Electric sensing edge.
  - b. Operator Controls:
    - 1) Push-button and key operated control stations with open, close, and stop buttons.
    - 2) Controls for both interior and exterior location.
    - 3) Controls surface mounted.
  - c. Special Operation:
    - 1) Radio control operation.

- 2) Card reader control.
  - d. Motor Voltage: 115/230 single phase, 60 Hz.
- 11. Windload Design:
  - a. Standard windload shall be 25 PSF.
- 12. Locking:
  - a. Interior slide bolt lock for electric operation with interlock switch.
- 13. Wall Mounting Condition:
  - a. Face-of-wall mounting.
  - b. Between jambs mounting.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify opening sizes, tolerances and conditions are acceptable.
- B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Division 26. Complete wiring from disconnect to unit components.
- F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 90 00.
- G. Install perimeter trim and closures.
- H. Instruct Owner's personnel in proper operating procedures and maintenance schedule.

3.4 ADJUSTING

- A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

- A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
- B. Remove labels and visible markings.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

- A. Protect installed products until completion of project.

3.7 SCHEDULE BY DOOR NUMBER

- A. Door Nos. 122A, 122C, and 101D: 12'w x 9'-0"h – Existing opening with existing coiling door to be replaced. Existing door has been installed in a supplementary steel frame constructed to the interior of the opening. Contractor shall cut free the existing door and guides and then install the new door and welded clips.
- B. Door No. 101E: 12'w x 9'-0"h – Existing opening with existing coiling door to be replaced. Existing door is mounted to the face of the exterior brick. Door shall be removed from the exterior brick and then existing masonry shall be patched and cleaned. The new door shall be placed to the interior. Head shall be mounted below existing conduit. Hood bottom will be approximately 6" below masonry opening lintel. Guides will be installed with expansion bolts to existing CMU wall.
- C. Door 124: 6' x 8'-0" steel weave mesh grille. See Section 08 31 00.

**END OF SECTION**

SECTION 08 41 00  
ALUMINUM FRAMED STOREFRONTS

PART 1 GENERAL

1.1 SUMMARY

- A. Work of this Section includes materials, labor, equipment, services necessary to complete the installation of the monumental lobby storefront, as indicated on the Drawings and specified herein, including the following:
  - 1. Lobby storefront system consisting of a faceted stick-built aluminum frame system that is four-sided structurally glazed, with fixed vision units.
  - 2. Entrance systems including glass enclosed vestibule and entry glass doors.
  - 3. Glass and glazing in conjunction with the work of this Section.
  - 4. All necessary steel or aluminum members where required to support, strengthen and/or reinforce aluminum members.
  - 5. Sealants, caulking, joint fillers, gaskets, fasteners, weeps, closures, flashings, trim, as shown or as may be required in conjunction with the system or to join the system to adjacent construction.
  - 6. Anchors, embeds with engineering and layout drawings.
  - 7. Two continuous lines of caulking to be provided throughout.
  - 8. Metal flashing
  - 9. Safety glass where required by Code.
  - 10. Visual Mock-up (approx.400 sq. ft.). Include lobby storefront typical head, intermediate horizontal mullion, sill, and jamb.
- B. Related Sections:
  - 1. Section 07 90 00 - Joint Protection: System perimeter sealant and back-up materials.
  - 2. Section 08 71 00 - Door Hardware: Mortised hardware reinforcement requirements affecting framing members; hardware items other than specified in this section.
  - 3. Section 08 80 00 - Glazing.
  - 4. Single Source Requirement: All products listed below shall be from same manufacturer.
    - a. 08 44 13 – Glazed Aluminum Curtainwall.

1.2 REFERENCES

- A. Work shall comply with governing agencies having jurisdiction. Project will be filed under IBC 2015 Building Code.
- B. Aluminum Association:
  - 1. AA ADM 1 - Aluminum Design Manual.
- C. American Architectural Manufacturers Association:
  - 1. AAMA 501 - Methods of Test for Exterior Walls.
  - 2. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Glass Doors.
  - 3. AAMA 503 - Voluntary Specification for Field Testing of Metal Storefronts. Curtain Wall and Sloped Glazing Systems.
  - 4. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
  - 5. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

6. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
  7. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
  8. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
  9. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
  10. AAMA MCWM-1 - Metal Curtain Wall Manual.
  11. AAMA SFM-1 - Aluminum Store Front and Entrance Manual.
- D. American Society of Civil Engineers:
1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- E. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
  2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  5. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  7. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  8. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  9. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  10. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
  11. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.
- F. National Fenestration Rating Council Incorporated:
1. NFRC 100 - Procedures for Determining Fenestration Product U-Factors.
- G. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- H. SSPC: The Society for Protective Coatings:
1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
  2. SSPC Paint 25 - Red Iron Oxide, Zinc Oxide, Raw Linseed Oil, and Alkyd Primer.
- I. Underwriters Laboratories Inc.:
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

### 1.3 TESTING AND PERFORMANCE REQUIREMENTS

- A. System Design: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, including building corners. The wall shall be designed so that failure of any one element (e.g. bolt, anchor, embed) will not result in progressive failure of the wall.
1. Design pressures shall comply with ASCE7.
- B. Test Reports: Provide manufacturer's test data from accredited third party testing agency showing compliance with specified performance requirements.
1. Uniform Load Deflection:  
At 100% design wind pressure:
    - a. Deflection Normal to Wall Plane: Net deflection for aluminum framing members supporting glass shall not exceeding  $L/175$  or  $3/4$  inch, whichever is less.
    - b. Deflection Parallel to Glazing Plane: Limited to  $L/360$  of clear span or  $1/8$  inch, whichever is less.
    - c. At 50 percent of design pressures, glass center deflection relative to glass edges shall not exceed  $L/50$  or one inch.
  2. System Assembly: Accommodate without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.
  3. Air Infiltration:
    - a. Fixed Wall: Limit air leakage through assembly to 0.06 cfm/sq ft of wall area at 6.24 psf static air pressure difference, when tested in accordance with ASTM E283.
    - b. Entry Doors: 0.50 cfm/sq ft for single doors, 1.00 cfm/sq ft for doors hinged in pairs, when tested at 1.567 psf per ASTM E283.
  4. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and inner sheet of infill panel and heel bead of glazing compound.
  5. Water Penetration under Static Pressure: Test system in accordance with ASTM E331.
    - a. Performance: No leakage when tested in at specified test pressure.
    - b. Test Pressure: Not less than 20 percent of design wind pressure, with minimum pressure differential of 2.86 lbf/sq ft and maximum of 12.00 lbf/sq ft.
  6. Thermal Transmittance of Assembly (Excluding Entrances): Maximum U Value of 0.45 Btu/sq ft per hour per deg F when measured in accordance with AAMA 1503 and NFRC 100. SHGC shall be 0.28
  7. Condensation: There shall be no interior condensation on visible surfaces or those that would wet insulation when the wall is subjected to 0° F exterior, 70° F interior, 30% interior relative humidity, 15 mph exterior wind.
  8. Thermal component shall be based on minimum material temperature increase of 200 degrees F and decrease of 180 degrees F relative to nominal condition. Assume entire cross section has uniform temperature. Components including adhesives and sealant shall be capable of withstanding, without failure, design temperatures with simultaneous specified loads. For thermal design other than joint movement, design winter surface temperature is -20 degrees F. Design

summer surface temperature shall be at least 180 degrees F. All components including adhesives and sealants shall be capable of withstanding (and remain durable) without failure design temperatures with simultaneous specified loads.

9. Building Movements:
  - a. The exterior wall system and components shall be designed to accommodate erection tolerances. The documents shall require the contractor to field measure. Final tolerances shall be coordinated among the various materials.
  - b. The exterior wall system shall be capable of accommodating a +/- 1.5" tolerance in building structure. This tolerance is intended to account for placement of concrete and steel and initial deflection that could occur prior to panel wall installation (short term movements). These tolerances will be taken up within the anchorage system designed by the curtain wall vendor. The unitized wall system and components shall be capable of accommodating live load and dead load movements including anticipated drift as provided by the Structural Engineer.
  - c. Provide movable joints to accommodate the full range of manufacturing tolerances, field tolerances, building sway, seismic movement and floor sag. Provide for inter-story movement due to live load deflection, building drift and thermal movement. Accommodate displacement of adjacent stories: Project Structural Engineer to provide values.
    1. Live Load Deflection of Structure: The greater of L/360 or 1"
    2. Long Term Creep and Column Shortening: The greater of L/360 or 1"
    3. Wind Lateral Drift: H/600
    4. Seismic Lateral Movement: H/400
  - d. Lateral displacement of any floor, measured parallel to the facade or perpendicular to the facade shall be assumed to occur while floors immediately above and below remain totally stationary. There shall be no failure or gross permanent distortion of anchors, frames, glass, or panels; gaskets and weather strips shall not disengage; weather seals shall not fail.
  - e. The wall system and components shall be designed to meet code seismic requirements.
10. Acoustic Performance: None.
11. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.

#### 1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.
  1. Provide large scale shop drawings for fabrication, installation and erection of all parts of work.
  2. Provide plans, elevations, and details of anchorages, connections and accessory items.
  3. Identify all materials including metal alloys, glass types, fasteners, sealant, glazing materials, sizes, thickness and finishes.
  4. Identify all shop and field sealants by product name and locate on drawings.
  5. Provide installation templates for work installed by others.
  6. Show interfaces and relationships to work of other trades.



- C. Product Data: Submit manufacturers printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used.
  - 1. Provide certifications that materials and systems comply with specified requirements.
  - 2. Submit component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.
- D. Samples: Submit two samples 12 x 12 inches in size illustrating each material that is to be exposed in completed work (finished aluminum surface, infill panels, glazing materials, etc.).
  - 1. Show full color ranges and finish variations expected.
- E. Design Data: Indicate framing member structural and physical characteristics, calculations, dimensional limitations.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- G. Calculations: Provide professionally prepared calculations and certification of performance of this work. Calculations shall be signed and sealed by a Professional Engineer registered in the State of Maryland.
  - 1. Indicate how design requirements for loading and other performance criteria have been satisfied.
- H. Test Reports: Provide certified test reports for specified tests from a qualified independent testing agency showing compliance with performance requirements based on comprehensive testing of manufacturer's systems.
- I. Thermal models for typical head, sill, jamb conditions.
- J. Submit Quality Assurance/Quality Control Program for the manufacture and installation of the storefront units, prior to start of work.
- K. Submit confirmation of compliance with Energy Code requirements.
- L. Submit sealant lab test reports for adhesion, compatibility and staining for all sealant/substrate combinations.
- M. Submit plan reviews by sealant and glass manufacturer approving details are suitable for the use of their product.
- N. Glass load-stress analysis verifying glass thickness, make-up and heat treatment.
- O. Signed and sealed as-built drawings and calculations for Owner records.
- P. Submit maintenance manual for all aluminum windows and doors including glass and glazing.

## 1.5 QUALITY ASSURANCE

- A. Visual Aesthetic Mock-up: Construct and erect a typical storefront module, including full size glass, for aesthetic review prior to commencement of construction. Scope of visual mockup to be 400 sq. ft.
- B. Perform Work in accordance with AAMA SFM-1 and AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

## 1.6 QUALIFICATIONS

- A. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum ten years documented experience, and with service facilities within 100 miles of Project.
- B. Design structural support framing components under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Maryland.

## 1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 31 00 – Project Management and Coordination: Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

## 1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Handle Products of this section in accordance with AAMA MCWM-1 - Curtain Wall Manual #10.
- C. Protect finished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
- D. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Store under cover and protect from weather damage.

## 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Do not install sealants nor glazing materials when ambient temperature is less than 40 degrees F during and 48 hours after installation.

## 1.10 COORDINATION

- A. Section 01 31 00 – Project Management and Coordination: Coordination and project conditions.

## 1.11 WARRANTY

- A. Section 01 77 00 – Closeout Procedures: Product warranties and product bonds.
- B. The overall system shall be warranted for no less than five (5) years, material and labor, including faulty glass replacement. Certain materials and components shall have longer warranties (sealants). The manufacturers shall state the warranties included and any premium to increase warranties if requested by the Owner. System warranty includes materials and labor and is a joint warranty signed by both the manufacturer and the Trade Contractors
- C. Insulated Glass Unit Warranty: Insulated glass units edge seal shall be warranted for a period of 10 Years (Replacement Labor included) and 10 Years (Material). The warranty for the glass must include labor and material in the event of a “systemic failure.”
- D. Aluminum Finish Warranty: Ten (10) years material and labor warranty
- E. Sealant Warranty: Twenty (20) year material and labor warranty

- F. Provide written warranty, signed by manufacturer, agreeing to repair or replace work that exhibits defects in materials or workmanship. "Defects" is defined to include, but not limited to, leakage of water, abnormal aging or deterioration, abnormal deterioration or fading of finishes, and failure to perform as required. Include requirement for removal and replacement of covering and connected adjacent work.

## PART 2 PRODUCTS

### 2.1 ALUMINUM-FRAMED STOREFRONTS

- A. Manufacturers:
1. Kawneer Co., Inc.; Trifab 451UT (Basis of Design)
  2. Wausau
  3. EFCO Corp.
  4. Traco.
  5. Substitutions: Section 01 60 00 - Product Requirements.
- B. Product Description:
1. Aluminum Frame: Thermally broken; applied glazing stops; drainage holes; internal weep drainage system. Frames for interior glazing need not to be thermally broken. Size mullions as required to withstand loads. The design intent is to avoid having an exposed steel bracing at the lobby and use internal reinforcement to limit deflection.
  2. Mullions: Profile of extruded aluminum with internal reinforcement of aluminum or shaped steel structural section.
  3. Doors: Aluminum framed thermally broken, insulated (Megatherm 50XT) glass doors; 1-3/4 inches thick, nominal 6 inch wide top rail and vertical stiles, nominal 10 inch wide bottom rail (medium stile) with; square glazing stops.

### 2.2 NON-THERMAL INTERIOR STOREFRONT:

1. Kawneer Company Inc.
2. Trifab™ 400 Framing System (Non-Thermal)
3. System Dimensions: 1-3/4" x 4" (44.5 mm x 101.6 mm)
4. Glass: Center Plane

### 2.3 COMPONENTS

- A. Extruded Aluminum: ASTM B221; 6063 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.
- B. Sheet Aluminum: ASTM B209, 5005 alloy, H15 or H34 temper.
- C. Sheet Steel: ASTM A653/A653M; galvanized to minimum G90.
- D. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections, galvanized.
- E. Glass:
1. Glass shall be 1" dual sealed insulating glass units with 1/4" typical lites and 1/2" air space meeting ICGG CBA rating. Glass thicknesses should be increased where required by load, code and to meet flatness criteria defined here within. The glass should be provided with a ten (10) year warranty. The warranty for the glass must include labor in the event of a "systemic failure".
    - a. Storefront glass consists of vision IGU that has low-iron, heat strengthened glass, with a low-e coating on #2 surface.
    - b. Refer to Section 08 80 00.

2. Glass shall be as selected by Architect or approved equal, Glass manufacturers to include Viracon, Interpane, or approved equal.
3. Each vendor bidding the project shall confirm that the glass types installed within their system meets the Energy Code requirements.
4. Tempered and Heat Soaked safety glass or Laminated Glass shall be used where required by Code and in general adjacent to doors, within 18" of finished floor, and where windows could be mistaken for means of egress.
5. Tempered glass shall be used only where required by code or load and shall be heat soaked to reduce the probability of spontaneous breakage.
6. The IGU center deflection relative to glass edges at 50 percent of specified design pressures shall not exceed 1". Glass deflection at 1.5 times design pressures shall be limited to prevent disengagement from frame.
7. All glazing details shall be reviewed and accepted by the glass manufacturer.
8. The glass manufacturer shall perform a thermal, stress, compatibility and load analysis.
9. The glass manufacturer shall review and advise on thermal stresses on glass due to heat build-up from window treatment placement. Window vendors to provide specific instructions for placement of window treatments adjacent to window system.
10. Primary insulated glass seal, polyisobutylene (PIB), to have a minimum of one-half of the bond width in contact with the deleted glass surface.
11. Primary insulated glass seal, polyisobutylene (PIB), to be fully compatible with all adjacent substrates and materials.
12. Secondary structural sealant within the insulated glass unit (IGU) must be processed in a closed system free from exposure to air. There must be no air entrained in the secondary structural IGU edge seal.
13. When using patterned insulated glass, there may be a potential to see a moiré pattern develop in the glass when viewed in certain light conditions and at specific solar angles. Moiré is an optical phenomenon that may present itself as a "wavy, rippled or circular" pattern under certain conditions. Moiré patterns can be created whenever one semi-transparent object with a repetitive pattern is placed over another. It is recommended that a full size mock-up be evaluated if patterned glass is being considered. The mock-up should be installed at the building site to better evaluate lighting conditions and be viewed at different times of day and under varying temperature conditions.
14. Optical Clarity and flatness shall be judged by the Architect from full-size glass samples and through the sample submission. The visual and performance mock-up shall represent the range of quality to be provided for the project. Rollerwaves on heat treated glass shall all be orientated in the same orientation, parallel to grade. Maximum peak to valley rollerwave shall be 0.003" in the center of the glass and 0.008" within 14" of the leading and trailing edge of the glass. The overall bow-warp of the glass shall be per ASTM standards. Glass observed with visible iridescence or quench marks from the heat treat process shall be rejected and replaced. Color variation between should not exceed 2 delta-E from the approved sample.

- F. Glazing Materials: As specified in Section 08 80 00.
- G. Hardware: Furnish manufacturer's standard door hardware for types of doors and applications indicated, and as specified below.
  - 1. Weather Stripping: Polypropylene pile, continuous and replaceable.
  - 2. Sill Sweep Strips: Resilient seal type, of neoprene compound.
  - 3. Threshold: Specified in Section 08 71 00.
  - 4. Hinges: Specified in Section 08 71 00.
  - 5. Push/Pull: Specified in Section 08 71 00.
  - 6. Panic Device: Specified in Section 08 71 00.
  - 7. Closer: Specified in Section 08 71 00.
  - 8. Finish: Exposed hardware to match hardware finishes specified in Section 08 71 00.
  - 9. Lock Cylinders: Specified in Section 08 71 00.
- H. Flashings: Minimum 0.032 inch thick aluminum to match mullion sections where exposed.
- I. Sill Flashing: Storefront to be installed on top of a stainless steel flashing with drip edge. Flashing shall be bed in sealant.
- J. Sealant and Backing Materials:
  - 1. Sealant Used within System (Not Used for Glazing): Manufacturer's standard materials to achieve weather, moisture, and air infiltration requirements.
  - 2. Perimeter Sealant: Specified in Section 07 90 00.
  - 3. Glazing sealants shall be high-grade, non-staining non-bleeding silicone. Sealants within the systems shall be compatible and adhere to silicone. The perimeter sealant between system and adjacent material shall be high-grade silicone. Sealant colors to be selected by the architect. Manufacturer testing shall be performed prior to construction including laboratory testing to confirm adhesion, compatibility, and staining of applicable surfaces and materials. Sealant shall be Dow Corning or Mumentive.
  - 4. Sealants shall contain a 20-year VIP material and labor warranty.
  - 5. Responsibility for sealant work shall be included in the exterior wall contract to obtain a single source warranty. Sealant work within the wall system, and between the wall system and adjacent construction shall be in the wall vendor's contract.
  - 6. Rain screen systems utilizing gaskets are equally acceptable and subject to compliance with performance requirements. Outdoor gaskets shall be silicone, neoprene, or Santoprene. Indoor gaskets shall be silicone, neoprene, Santoprene, or EPDM.
- K. Fasteners: Provide Non-magnetic Stainless steel, warranted by manufacturer to be non-corrosive and compatible with aluminum components.
  - 1. All fasteners exposed to moisture shall be series 300 stainless steel.
  - 2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 3. Reinforce members as required to receive fastener threads.
- L. Brackets and Reinforcement: Non-magnetic stainless steel or hot-dip galvanized steel complying with ASTM A386.

- M. Concrete/Masonry Inserts: Hot-dip galvanized steel complying with ASTM A 386.
- N. Anchor clips and aluminum surfaces that receive sealant shall be anodized or painted. No mill finish shall be used on surfaces exposed to moisture or to receive sealant.
- O. Dissimilar Metal Separation: Separate dissimilar metals with bituminous paint or plastic shims.
- P. Bituminous Coatings: Cold-applied asphalt mastic compounded for 30 – mil thickness per coat.
- Q. Setting blocks: Provide setting blocks at the sill quarter points of all glass lites. Setting blocks shall be heat cured silicone rubber with a hardness of 80 to 90 durometer, Shore A, a minimum length of 4”, and a minimum width, which will perimeter full support of both panes of glass in an insulating glass unit or a monolithic unit no matter how positioned within the glazing rabbet. Location of setting blocks at glass quarter points is acceptable. Distance from vertical glass edge to nearest edge of setting block shall not be less than six inches.

## 2.4 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Arrange fasteners and attachments to conceal from view.
- E. Reinforce interior horizontal head rail to receive drapery track brackets and attachments.
- F. Prepare components with internal reinforcement for door hardware.
- G. Reinforce framing members for imposed loads.
- H. Reinforcing: Install reinforcing as necessary for performance requirements; separate dissimilar metals with bituminous paint or other separator to prevent corrosion.

## 2.5 SHOP FINISHING

- A. Clear Anodized Aluminum Surfaces: AAMA 611, AA-M12C22A41 non-specular as fabricated mechanical finish, medium matte chemical finish, and Architectural Class I 0.7 mils clear anodized coating.
- B. Concealed Steel Items: Galvanized to ASTM A123/A123M; minimum 2.0 oz/sq ft coating thickness; galvanize after fabrication. Unfinished.
- C. Apply bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar metals.
- D. Shop and Touch-Up Primer for Steel Components: SSPC Paint 25 red oxide.
- E. Touch-Up Primer for Galvanized Steel Surfaces: SSPC Paint 20 zinc rich.
- F. Extent of Finish:

1. Apply factory coating to surfaces exposed at completed assemblies.
2. Apply finish to surfaces cut during fabrication so no natural aluminum is visible in completed assemblies, including joint edges.
3. Apply touch-up materials recommended by coating manufacturer for field application to cut ends and minor damage to factory applied finish.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Section 01 31 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify dimensions, tolerances, and method of attachment with other Work.
- C. Verify wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.

#### 3.2 INSTALLATION

- A. Install wall system in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent Work to form water tight dam.
- G. Coordinate attachment and seal of perimeter air and vapor retarder materials.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Install integral flashings and integral joint sealers.
- J. Set thresholds in bed of mastic and secure.
- K. Install hardware using templates provided. Refer to Section 08 71 00 for installation requirements.
- L. Install infill panels using method required to achieve performance criteria.
- M. Coordinate installation of glass with Section 08 80 00; separate glass from metal surfaces.
- N. Coordinate installation of perimeter sealants with Section 07 90 00.
- O. Provide protection against galvanic action. Isolate dissimilar materials with bituminous coating or non-absorptive dielectric tape.

- P. Install aluminum entrance doors and storefront framing in openings prepared under other sections plumb, square, level, in exact alignment with surrounding work, with proper clearances and securely and positively anchored to building structure, to meet performance requirements specified herein, in accordance with manufacturers published instructions and approved submittals.

### 3.3 ERECTION TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.
- C. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

### 3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspection to monitor quality of installation and glazing.
- C. Test to ASTM E1105.

### 3.5 ADJUSTING

- A. Section 01 77 00 – Closeout Procedures: Testing, adjusting and balancing.
- B. Adjust operating hardware for smooth operation.

### 3.6 CLEANING

- A. Section 01 77 00 – Closeout Procedures: Final cleaning.
- B. Remove protective material from pre-finished aluminum surfaces.
- C. Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- D. Remove excess sealant by method acceptable to sealant manufacturer.

### 3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 50 00 – Temporary Facilities and Controls: Protecting installed construction.
- B. Protect finished Work from damage during fabrication, shipping, storage, and erection. Exterior wall materials and components shall be stored off the ground and covered until installation. Glass shall be protected to meet the written instructions from the glass manufacturer. All manufacturers shall provide additional handling recommendations and requirements.

### 3.8 SCHEDULES

- A. Refer to Drawings.

END OF SECTION



SECTION 08 44 13  
GLAZED ALUMINUM CURTAINWALL

PART 1 GENERAL

1.1 SUMMARY

- A. Work of this section includes: Materials, labor, equipment, services necessary to complete the installation of the curtain wall, as indicated on the Drawings and or specified herein including the following:
  - 1. All exterior curtainwall and window wall furnished and installed as shown on drawings, specified in this section and designated in the AAMA MCWM-1 "Metal Curtainwall Manual".
  - 2. All labor, materials, tools, equipment and services needed to furnish and install curtain wall.
  - 3. Components furnished with installed curtain wall.
  - 4. Installation accessories furnished and installed.
  - 5. Glass and glazing in conjunction with the work of this Section.
  - 6. All necessary steel or aluminum members where required to support, strengthen and or reinforce aluminum members.
  - 7. Sealants, caulking joint fillers, gaskets, fasteners, vents and weeps, weep tubes, bellows, closures, gutters, end dams, flashings, trim, as shown or as required in conjunction with the system or to join the system to adjacent construction.
  - 8. Curtain wall anchors at floor slab edges, reinforcement, and anchor attachments to the building structure. Anchor may be placed at the face of slab where a top of slab anchor is not possible. Provide layouts, details and requirements for anchorage points for approval by the Structural Engineer.
  - 9. Two continuous lines of sealant shall be used throughout.
  - 10. Metal copings and coordination with counter flashings, waterproofing membranes and interfaces with roofing.
  - 11. Safety glass where required by Code.
  - 12. Thermal insulation and vapor barrier as shown on the drawings and specified herein.
  - 13. Shop drawings, engineering calculations, erection drawings, samples and conformance test data.
  - 14. Thermal modeling.
  - 15. Protection and cleaning as defined herein.
  - 16. Field Measurements of adjacent and or supporting construction and verification of existing conditions.
  - 17. Field touch up of finishes after installation and final adjustments.
  - 18. Attic stock.
- B. Related Sections
  - 1. Section 07 90 00 - Joint Protection: System perimeter sealant and back-up materials.

2. Section 08 71 00 - Door Hardware: Mortised hardware reinforcement requirements affecting framing members; hardware items other than specified in this section.
3. Section 08 80 00 - Glazing.
4. Single Source Requirement: All products listed below shall be from same manufacturer.
  - a. 08 41 00 – Aluminum Framed Storefronts

## 1.2 REFERENCE

- A. Work shall comply with governing agencies having jurisdiction. Project will be filed under IBC 2015 Building Code.
- B. Refer to AAMA MCWM-1 "Metal Curtainwall Manual" for a complete list of references and industry standards.

## 1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified herein representing those indicated for this Project without failure due to defective manufacture, fabrication, installation or other defects in construction.
  1. Glazed aluminum curtain walls shall withstand movements of supporting structure and deflection from uniformly distributed and concentrated live loads.
  2. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening fasteners, attachments, and other components.
    - e. Failure of operating units.
- B. Delegated Design: Design glazed aluminum curtain walls including comprehensive engineering analysis by a qualified professional engineer licensed in the State of Maryland, including but not limited to story drift, twist, column shortening, long term creep, seismic, using performance requirements and design criteria indicated. Submit calculations for review by the architect, project structural engineer, and consultants prior to fabrication.
- C. Testing: Where manufacturer's standard curtain wall complies with requirements and has been tested in accordance with specified tests in the last 3 years, provide certification with such tests for the record only. Perform required laboratory mock-up tests through an AAMA accredited testing laboratory or agency and provide certified test results to the Architect and Owner for information and record. All evaluation and test specimens shall be complete assemblies and represent project conditions including reinforcing, anchoring methods, panning and trim. Provide detail drawings associated with the submitted product and results.
- D. Design Wind Loads
  1. The design wind pressure for the project will be:
    - a. Per ASCE 7 Analysis
  2. All structural components, including meeting rails, mullions and anchors shall be designed accordingly, complying with deflection and stress requirements of Paragraph 1.3.B.
- E. Water, and Structural Performance Requirements
  1. When tested in accordance with cited test procedures, curtainwall shall meet or exceed the following performance criteria, as well as those indicated in the AAMA "Metal Curtainwall Manual", unless otherwise noted herein.

2. Air Test Performance Requirements
  - a. Fixed Wall: Limit Air leakage through assembly to 0.06 cfm/sq ft of wall area at 6.24 psf static air pressure difference when tested in accordance with ASTM E283.
3. Water Test Performance Requirements
  - a. Performance: No leakage when tested at specified test pressure per ASTM E331.
  - b. Test Pressure: Not less than 20 percent of design wind pressure, with minimum pressure differential of 6.24 psf.
4. Structural Test Performance Requirements (at Design Pressure)
  - a. Uniform Load Deflection Test (At 100% design wind pressure)
    - 1) Deflection Normal to Wall Plane: Net deflection for aluminum framing members supporting glass shall not exceed  $L/175$  or  $\frac{3}{4}$  inch, whichever is less, for spans up to 13'-6", and  $L/240$  plus  $\frac{1}{4}$  inch for spans greater than 13'-6".
      - a) Primary aluminum members shall be 0.125" thick minimum.
      - b) Covers and ornamental sections shall be 0.125" thick minimum and reinforced as required to provide a uniform appearance.
      - c) Overall mullion depths shall be kept to a minimum although structural performance shall govern.
      - d) Reinforcement, if required, shall be within the mullions.
    - 2) Deflection Parallel to Glazing Plane: Limited to  $L/360$  of clear span or  $\frac{1}{8}$  inch, whichever is less.
    - 3) At 50 percent of design pressures, glass center deflection relative to glass edges shall not exceed  $L/50$  or one inch, whichever is less.
5. Structural Test Performance Requirements (at 1.5 x Design Pressure)
  - a. Uniform Load Structural Test
    - 1) Specimen to be tested at 1.5 x design test pressure, both positive and negative, acting normal to plane of wall in accord with ASTM E330.
    - 2) No glass breakage; permanent damage to fasteners, hardware parts, or anchors; damage to make curtainwall insert vents inoperable; or permanent deformation of any main frame member in excess of 0.2% of its clear span
6. Building Movements:
  - a. The exterior wall system and components shall be designed to accommodate erection tolerances. The documents shall require the contractor to field measure. Final tolerances shall be coordinated among the various materials.
  - b. The exterior wall system shall be capable of accommodating a  $\pm 1.5$ " tolerance in building structure. GC/CM to advise if more or less is needed. This tolerance is intended to account for placement of concrete and steel and initial deflection that could occur prior to curtain wall installation (short term movements). These tolerances will be taken up within the anchorage system designed by the curtain wall vendor. The unitized wall system and components shall be capable of accommodating live load and dead load movements including anticipated drift as provided by the Structural Engineer.
  - c. Provide movable joints to accommodate the full range of manufacturing tolerances, field tolerances, building sway, seismic movement, and floor sag. Provide for inter-story movement due to live load deflection, building drift and thermal movement. Accommodate displacement of adjacent stories: Project Structural Engineer to provide values.
    - 1) Live Load Deflection of Structure: \_

- 2) Long Term Creep and Column Shortening: \_
      - 3) Wind Lateral Drift: \_
      - 4) Seismic Lateral Movement: \_
    - d. Lateral displacement of any floor, measured parallel to the façade or perpendicular to the façade shall be assumed to occur while floors immediately above and below remain totally stationary. There shall be no failure or gross permanent distortion of anchors, frames, glass or panels; gaskets and weather strips shall not disengage; weather seals shall not fail.
    - e. The wall system and components shall be designed to meet code seismic requirements.
  - F. Condensation Resistance and Thermal Transmittance Performance Requirements
    - 1. Perform thermal tests in accordance with NFRC 102 and AAMA 1503, or provide finite element computer thermal modeling and calculations per NFRC 100 or AAMA 507, using DOE/LBL THERM 5.2 and WINDOWS 5.2 software.
      - a. Thermal Transmittance (U-Factor) for the overall curtainwall vision area and adjacent framing shall be less than or equal to  $0.40 \text{ BTU/hr-ft}^2 \cdot ^\circ\text{F}$ .
      - b. Thermal component shall be based on minimum material temperature increase of 200 degrees F and decrease of 180 degrees F relative to nominal condition. Assume entire cross section has uniform temperature. Components including adhesives and sealant shall be capable of withstanding, without failure, design temperatures with simultaneous specified loads. For thermal design other than joint movement, design winter surface temperature is -20 degrees F. Design summer surface temperature shall be at least 180 degrees F. All components including adhesives and sealants shall be capable of withstanding (and remain durable) without failure design temperatures with simultaneous specified loads.
      - c. Condensation Resistance requirements: There shall be no interior condensation when the wall is subjected to 0 degrees F exterior, 70 degrees F interior, 30% interior relative humidity, 15 mph exterior wind.
      - d. Solar Heat Gain Coefficient (SHGC) for the overall curtainwall vision area and adjacent framing shall not exceed 0.28.
  - G. Acoustic Performance Requirements
    - 1. Perform acoustical tests in accordance with ASTM E90 and ASTM E1425 on the glass type(s) specified in 08 80 00, rigidly supported in aluminum framing of the same product family.
    - 2. "Glass-only" test results shall not be acceptable.
    - 3. Sound Transmission Class (STC) shall not be less than 35.
    - 4. Outdoor-Indoor Transmission Class (OITC) shall not be less than 26.
- 1.4 SUBMITTALS
- A. General Requirements
    - 1. Provide all submittals in a timely manner to meet the required construction completion schedule.
    - 2. Sample warranty.
    - 3. Names of all suppliers (glass, metal paint, etc.) and installers and key personnel including the Engineer of Record who shall be licensed by the State of Maryland, to be provided at the time of bidding.
    - 4. List of similar projects completed and references.

5. Statement of compliance with the design intent and commitment to comply with the Contract Documents. This shall include a line by line specification review noting and qualification or exclusion from the project specification. The bidder should provide information pertaining to proposed alternates or deviations to the documents.
  6. Project Schedule from award to substantial completion.
  7. Submit Quality Assurance/Quality Control Program for the manufacture and installation of the curtain wall and insulated glass units, prior to start of Work.
  8. Submit sealant lab test reports for adhesion, compatibility, and staining for all sealant/substrate combinations.
  9. Submit plan reviews by sealant and glass manufacturer approving details are suitable for the use of their product.
  10. Thermal models calculated per NFRC standards indicating overall system U-values.
  11. Condensation checks showing dew point line per project winter interior design conditions.
  12. Glass load-stress analysis verifying glass thickness, make-up and heat treatment.
  13. Submit Maintenance Manual for all aluminum windows and doors including glass and glazing.
  14. Submit confirmation of compliance with Energy Code requirements.
  15. Physical samples requested by the Architect.
  16. Project milestone dates for system design, testing, fabrication and erection.
- B. Shop Drawings
1. Shop drawings must be prepared wholly by the curtainwall manufacturer, or a qualified engineering services firm under the direction of the manufacturer. Shop drawings for pre-engineered configurations may be prepared by authorized installers.
  2. Proposal Drawings and Test Data: Proposal drawings must include all typical conditions including stack joints, anchors, vent details, shadow box details, corner conditions, termination with adjacent work and tolerances. Proposal drawings for curtain wall to include elevations with panelization. For windows provide typical head, jamb, and sill conditions.
  3. Provide design details along with bid proposals to define system aesthetic and functional characteristics.
  4. Provide up to three photocopied sets of shop drawings, including half size details of all necessary conditions.
  5. Shop drawings should be coordinated to show surrounding work and should be promptly updated throughout the project as architectural drawings and shop drawings from other trades are updated.
  6. Show joinery techniques and seals, provision for horizontal and vertical expansion, drainage and weep systems, range of tolerances, glass and metal thicknesses, structural sealant bond widths and framing member profiles.
  7. Identify all materials, including metal alloys, glass types, fasteners, sealant, and glazing materials, sizes, shapes, thickness, and finishes. Identify all shop and field sealants by product name and locate on drawings. Glazing details shall be at full size scale.
  8. Make clear by obvious graphic device (bubble, cloud) any and all deviations from the Contract Documents and revisions to shop drawings and submittals.

9. Signed and sealed as-built drawings and calculations for Owner records.
- C. Samples
  1. Components: Submit samples of anchors, fasteners, hardware, assembled corner sections and other materials and components as requested by Architect.
  2. Finish: Submit color samples for Architect's approval as requested.
  3. Physical samples, data sheets, performance characteristics, color renderings and bid pricing specifically including all glass types and metal finishes.
  4. Submit product data for each product specified, including details of construction relative to materials, dimensions of individual components, profiles and finishes.
  5. Submit samples for verification of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets show the full range of variations expected.
- D. Test Reports and Calculations
  1. Submit certified independent laboratory test reports verifying compliance with all test requirements of 1.3.
  2. Previous test reports performed within the last 5 years.
  3. Submit structural calculations prepared by a State of Maryland Registered Professional Engineer indicating adequacy of all materials furnished under this section, to meet the uniform and structural load requirements as specified in 1.3.
  4. Thermal modeling of curtain wall typical sill, head, jamb conditions.
  5. Proposed laboratory mock-up scope, configuration, test procedure and test facility.
  6. Submit test reports, calculations, computer analysis and other necessary data from a qualified independent inspecting and testing agency retained by the Contractor indicating compliance with performance requirements of glazed aluminum curtain wall system.

## 1.5 QUALITY ASSURANCE

- A. Qualifications: Upon request, the curtainwall manufacturer shall provide written confirmation that the installer is authorized to install curtainwall products to be used on this project.
- B. Submit Quality Assurance/Quality Control Program for the manufacture and installation of the curtain wall units, prior to start of work.
- C. Trade contractor shall furnish and install the items required for proper completion of the work without adjustment to the price. Work shall be structurally sound, quality construction and the contractor shall be solely responsible for the inclusion of adequate labor and materials to cover the proper and timely installation of the items indicated, described or implied. This is a performance specification and criteria for the solution of structurally sound work as indicated on the drawings and herein specified for the sole purpose of defining the design intent and performance requirements. The details shown are intended to emphasize the acceptable performance requirements for this project and the general orientation, arrangement and dimensional coordination necessary for the Contractor to fulfill its obligations as described within the executed contract.
- D. Trade contractor shall enact QA/QC program of inspection to verify that their Work meets all their obligations and conforms with approved documents. Trade Contractor shall present evidence that they enact such a program on an on-going basis during fabrication and construction.

- E. Framing members:
  - 1. Glass, sealants and interior finishes shall not be assumed to contribute to framing member strength, stiffness or lateral stability.
  - 2. Compression flanges of flexural members may be assumed to receive effective lateral bracing only from (a) anchors to building structural and (b) horizontal glazing rails or interior trim which contact the compression flange. Points of contra flexure shall not be regarded as lateral braces or as end points of an unbraced length; un-braced length shall be the distance between effective lateral braces.
  - 3. Where a framing member reaction is resisted by a continuous element, maximum assumed effective length of resisting element shall be four times the bearing length, but not more than one-foot.
  - 4. Splice joints, which permit movement, shall be assumed to have zero movement capacity.
  - 5. Where a framing member runs continuously past a deflecting support, combined deflection of member and support shall not exceed specified limits
- F. Stack joint and corner mullions should be sized to accommodate anticipated building movements, thermal movements, and installation tolerances. Design differential floor edge vertical movement between successive floors to comply with structural engineers requirements for the project. Exposed members should have consistent sight lines.
- G. Snap engagement components shall be secured against migration, and shall not serve any primary structural function, such as retention of glass or panels. Provide mechanical fastening of all exterior assemblies, not relying solely on compression friction fit. Snap engaged plastic components are not permitted, except as non-structural thermal improvement for interior trim. Joints in continuous snap covers and other continuous trim shall have splice sleeves of same material and finish as cover or trim.
- H. System should contain gasketed male-female joints and be internally reinforced where required to meet design conditions. Where windows cannot be internally reinforced, additional members should be added to the interior side of the window system and must be consistent throughout the apartment where they exist. Reinforcement should not be added to the exterior of the façade.
- I. Aluminum panels should be fabricated in .125" (minimum). Extruded members and panels shall provide a uniform appearance. Provide stiffeners where required.
- J. All fasteners in wet areas or outboard of the system airseal shall be stainless steel.
- K. All window assemblies and components should contain internal drainage system.
- L. Engineering Judgment for perimeter slab firesafing showing compliance with UL tested assemblies and applicable codes.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading
  - 1. Materials will be packed, loaded, shipped, unloaded, stored and protected in accordance with AAMA CW-10.
- B. Protective film should be provided on trim and panels and removed after trim installation. Windows and components should be stored off the ground and covered until installation. Manufacturers should provide additional handling recommendations and requirements. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations.

- C. Temporary protection should be provided immediately after windows are installed and maintained until substantial completion.

## 1.7 WARRANTY

- A. Aluminum Curtain wall Warranty
  - 1. Products: Submit a written warranty, executed by the curtainwall manufacturer, for a period of five (5) years from the date of manufacture, against defective materials or workmanship, including substantial non-compliance with applicable specification requirements and industry standards, which result in premature failure of the curtainwall, finish, or parts, outside of normal wear.
- B. The overall system shall be warranted for no less than five (5) years, material and labor, including faulty glass replacement. Certain materials and components shall have longer warranties (sealants). The manufacturers shall state the warranties included and any premium to increase warranties if requested by the Owner. System warranty includes materials and labor and is a joint warranty signed by both the manufacturer and the Trade Contractors.
  - 1. In the event that curtain wall or components fail or are found defective, manufacturer will repair or provide replacements without charge at manufacturer's option. Failures include, but are not limited to, the following:
    - a. Structural failures including but not limited to, excessive deflection.
    - b. Noise or vibration caused by thermal movements.
    - c. Failure of system to meet performance requirements.
    - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - e. Chalking and fading of aluminum finishes.
    - f. Failure of operating components to function normally.
    - g. Water leakage.
    - h. Glazing breakage including secondary breakage caused by falling glass, spontaneous breakage of heat-treated glass.
    - i. Cracking, peeling or discoloration of low-E or reflective glass coating.
    - j. Glass failure including fogging of units and delamination.
    - k. Loss of glass bearing on setting blocks due to shifting of glass and/or blocks.
    - l. Abnormal deterioration, aging or weathering.
    - m. Air leakage exceeding specified limits.
    - n. Sealant, including structural silicone, ability to withstand loss of adhesion, loss of cohesion, cracking or discoloration.
    - o. Disengagements of gaskets or weatherstrips.
    - p. Collapse of thermal insulation.
  - 2. Warranty for all components must be direct from the manufacturer (non pass-through) and non pro-rated for the entire term. Warranty must be assignable to the non-residential owner, and transferable to subsequent owners through its length.
  - 3. Sealants shall have a 20 year VIP material and labor warranty.
- C. Insulated Glass Unit Warranty: Insulated glass units edge seal shall be warranted for a period of 10 years (Replacement Labor included) and 10 years (Material). The warranty for the glass must include labor and material in the event of "systemic failure".
- D. Aluminum Finish Warranty: Ten (10) years material and labor warranty.
- E. Installation: Submit a written warranty, executed by the curtainwall installer, for a period of five (5) years from the date of substantial completion, against defective materials or workmanship, including substantial non-compliance with applicable specification requirements, which result in premature failure.



1. In the event that installation of curtainwall or components is found to be defective, installer will repair or provide replacements without charge at the installer's option.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers
  1. Kawneer 1600 UT Series (Basis of Design)
  2. Tubelite 400SS Thermal Curtainwall
  3. Wausau Window and Wall Systems
  4. EFCO
  5. Substitutions: Section 01 60 00 - Product Requirements.

### 2.2 MATERIALS

- A. Aluminum Framing Members
  1. Extruded aluminum billet, 6063-T5 or T6 alloy for primary components; 6063-T5 or T6, 6005-T5, 6105-T5 or 6061-T6 for structural components; all meeting the requirements of ASTM B221.
  2. Aluminum sheet alloy 5005-H32 (for anodic finishing), or alloy 3003-H14 (for painted or unfinished sheet) meeting the requirements of ASTM B209.
  3. Principal extruded framing members will be a minimum 0.125" in thickness.
  4. Extruded or formed trim components will be a minimum 0.060" in thickness.
  5. System face width and depth dimensions shall nominally match those shown on architectural drawings.
    - a. Overall depth 7 ½" with standard 1" glass setback. Primary mullion split tube depth 5".
    - b. Exterior face dimension 2 ½" at vertical mullions
  6. Vertical mullions to be fully captured and/or structural glazed as indicated on architectural drawings.
  7. Horizontal intermediate framing members to be fully captured and/or structural glazed as indicated on architectural drawings.
  8. Fasteners and accessories: Provide non-magnetic stainless steel, warranted by manufacturer to be non-corrosive and compatible with aluminum components.
    - a. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, windloads, or vibration.
    - b. Reinforce members as required to receive fastener threads.
    - c. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
    - d. All fasteners exposed to moisture shall be series 300 stainless steel.

### 2.3 COMPONENTS

- A. Sealants
  1. All sealants shall comply with applicable provisions of AAMA 800 and/or Federal Specifications FS-TT-001 and 002 Series.
  2. Frame joinery sealants shall be suitable for application specified and as tested and approved by curtainwall manufacturer.
  3. Sealants (Non-structural):
    - a. All joints, which are sealed with sealant as part of the fabrication or erection procedure, shall be sealed with a high-grade, non-staining, non-bleeding, low modulus silicone (exposed or concealed) sealant in color to match the adjoining surfaces or as may be required by the Architect. All perimeter sealant (metal to adjacent construction) shall be low or

- medium modulus silicone sealant as manufactured by Momentive or Dow Corning.
  - b. In using specified sealants, strictly observe the printed instructions of sealant manufacturer regarding joint size, limitations, backer rod, mixing, cleaning, surface preparation, priming and application. A primer shall be used, unless printed instructions advise to the contrary, and sealant manufacturer certifies that the use thereof will reduce its performance. Sealant shall not be applied when substrates are wet or when the temperature is below 40 deg F.
  - c. Care shall be exercised to insure against “Three Surface Adhesion”. Bond breakers shall be provided where necessary.
  - d. Contractor shall provide certification from sealant manufacturer that the sealant manufacturer has reviewed all sealant details and finds same suitable for the purpose intended, compatible with and will not stain the surfaces with which they are in contact. Statement as to compatibility, adhesion sufficiency and non-staining shall be accompanied by actual test results on production substrates performed in accordance with applicable ASTM procedures.
  - e. Sealant within the systems should be compatible and adhere to silicone. The perimeter sealant, between window system and adjacent material should be high-grade silicone. Manufacturer testing should be performed prior to construction including adhesion, compatibility and stain resistance.
  - f. Sealant back-up materials shall be polyethylene foam or extruded silicone as recommended by sealant manufacturer. Back –up shall not absorb water.
4. Sealants (Structural):
- a. All components which are adhered with a structural silicone sealant as part of the fabrication, glazing or erection procedure, shall be sealed with an approved structural silicone, as manufactured by Momentive or Dow Corning and approved by the Architect. All glazing with structural silicone sealant shall be accomplished in a shop wherever consistent with the design.
  - b. In using specified sealants, strictly observed the printed instructions of sealant manufacturer regarding joints size, limitations, backer rod, mixing, cleaning, surface preparation, priming and application. A primer shall be used, unless printed instructions advise to the contrary. Sealant shall not be applied where substrates are wet, or when the temperature is below 40 deg F. Units shall not be moved until structural silicone has achieved full cure.
  - c. Care shall be exercised to insure against “Three Surface Adhesion”. Bond breakers shall be provided where necessary.
  - d. Contractor shall provide certification from sealant manufacturer that the sealant manufacturer has reviewed all sealant details and tested all contact surfaces, and finds same suitable for use with proposed sealant, the purpose intended and compatible with the surfaces with which they are in contact. Sealant manufacturer’s certification shall include the following based upon tests performed on production run materials:
  - e. Test data of adhesion to production samples of metal and glass, tested in accordance with ASTM C794.
  - f. Compatibility statement that the materials in contact with the sealant such as gaskets, spacers, setting blocks, are compatible with the sealant after 21 days exposure to ultra violet.
  - g. Stress statement that when exposed to the specified wind load the stress in the silicone sealant of dimensions shown does not exceed 20 psi with a safety factor of 5:1.

- h. Structural silicone shall not support dead load. Structural silicone shall be free of entrained air and shall have full contact with substrates per GANA standards.
    - i. Structural silicone shall not be applied to edges of insulating glass or to edges of laminated glass.
    - j. Glass or other infill material shall not be attached by structural silicone on both sides of a frame movement joint.
- B. Glass
  - 1. Glass: Clear, insulated double glazed units with Low –E coating, air cavity with metal spacer. Thickness as needed to resist project wind loads and minimize distortion, not less than 1" overall (1/4" exterior lite, 1/2" air cavity, 1/4" interior lite as a baseline, increase thickness as required to meet performance requirements). Air space to have desiccant filled metal (aluminum or stainless steel) spacer with welded, fused, soldered or bent corners and welded, fused or soldered splices or joints to provide a 1/2" hermetically sealed and dehydrated space. Insulating glass shall be dual seal and certified for compliance with seal classification "CBA" by the Insulating Glass Certification Council (IGCC) and tested in accordance with the following ASTM Test methods. Primary seal shall be polyisobutyl (PIB). Secondary seal on structural silicone glazed units shall be a special silicone edge seal certified for use in structural silicone glazing applications over the temperature range and structural loading as called for under the performance criteria section of this Specification. There must be no air entrained in the secondary structural IGU edge seal.
    - a. E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.
    - b. E 546-88 Standard Test Method for Frost Point of Sealed Insulating Glass Units.
    - c. E 576-88 Standard Test Method for Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
- C. Glass shall be heat strengthened unless safety glass is required by code or by thermal loads. The glass edge seal shall be provided with a ten (10) year warranty. The warranty for the glass must include labor in the event of a "systemic failure." Solar heat gain coefficient and U-value shall meet requirements established by NYS Energy Code and Energy Model. Refer to architect's drawings for glazing schedule.
- D. Glass shall be of the types and minimum thickness as shown on the drawings and specified herein and shall, in addition, meet the requirements of the following paragraphs.
- E. Vision and spandrel glass shall match, subject to the Architect's approval of visual samples. Glass manufacturers to include Viracon, Interpane, or approved equal.
- F. Tempered/safety glass should be used only where required by code or loads including at end adjacent to doors, within 18 inches of finished floor, and where windows could be mistaken for means of egress.
- G. All tempered glass should be heat soaked or warranted for spontaneous breakage, labor included.
- H. The IGU center deflection relative to glass edges at 50 percent of specified design pressures shall not exceed 1". Glass deflection at 1.5 times design pressures shall be limited to prevent disengagement from frame.
- I. All glazing details shall be reviewed and accepted by the glass manufacturer.
- J. The glass manufacturer shall perform a thermal, stress, compatibility and load analysis.

- K. The glass manufacturer shall review and advise on thermal stresses on glass due to heat build-up from window treatment placement. Window vendors to provide specific instructions for placement of window treatments adjacent to window system.
- L. Primary insulated glass seal, polyisobutylene (PIB), to have a minimum of one-half of the bond width in contact with the deleted glass surface.
- M. Primary insulated glass seal, polyisobutylene (PIB), to be fully compatible with all adjacent substrates and materials.
- N. Glass shall conform to the requirements of ASTM C 1036. Heat strengthened and tempered glass shall conform to the requirements of ASTM C 1048. Tempered glass shall also conform to ANSI Z97.1-1975. All heat strengthening and tempering shall be by the horizontal process, and processed in such a manner as to have all roller distortion in a horizontal direction as installed on the building.
- O. Edge deletion of Low-E coating shall be performed in a manner that provides complete removal, without residual coating remaining on the glass surface. Coating shall be fully and completely edge deleted to the primary sealant PIB bondline.
- P. Secondary structural sealant within the insulated glass unit (IGU) must be processed in a closed system free from exposure to air.
- Q. When using patterned insulated glass, there may be a potential to see a moiré pattern develop in the glass when viewed in certain light conditions and at specific solar angles. Moiré is an optical phenomenon that may present itself as a “wavy, rippled or circular” pattern under certain conditions. Moiré patterns can be created whenever one semi-transparent object with a repetitive pattern is placed over another. It is recommended that a full size mock-up be evaluated if patterned glass is being considered. The mock-up should be installed at the building site to better evaluate lighting conditions and be viewed at different times of day under varying temperature conditions.
- R. Optical clarity and flatness shall be judged by the Architect from full-size glass samples and through the sample submission. The visual and performance mock-up shall represent the range of quality to be provided for the project.
- S. Rollerwaves on heat treated glass shall be orientated in the same orientation, parallel to grade. Maximum peak to valley rollerwave shall be 0.003” in the center of the glass and .008” within 14” of the leading and trailing edge of the glass.
- T. Glass observed with visible iridescence or quench marks from the heat treat process shall be rejected and replaced.
- U. Color variation between should not exceed 2 delta-E from the approved sample.
- V. Bow/Warp: In addition to conforming with ASTM C 1048, heat treated glass shall conform to the following flatness tolerance criteria.
  - 1. Bow and warp are defined as deviation of a glass surface from a true plane, with glass freestanding or installed in a frame and positioned in a vertical plane.
  - 2. Localized bow refers to any straight-line segment on a glass surface with length of 12 inches.
  - 3. Overall bow refers to any straight-line segment on a glass surface, which extends between opposite edges and is perpendicular to at least on edge. Length of line segment is gage length.
  - 4. Localized bow shall not exceed 0.0625 inch (1.6 mm).
  - 5. Overall bow shall not exceed 50% of the values listed in ASTM C 1048, Table 2.

- W. Insulated glass units shall be fabricated with aluminum or stainless steel spacer bars, spliced on straight runs only, maximum of 2 splices per IGU.
- X. Glazing
  - 1. Glazing method shall be in general accordance with the GANA Glazing Manual for specified glass type, or as approved by the glass fabricator.
- Y. Glazing Materials
  - 1. Setting Blocks/Edge Blocking: Provide in sizes and locations recommended by GANA Glazing Manual. Setting blocks used in conjunction with soft-coat low-e glass shall be silicone.
    - a. Provide setting blocks at sill quarter points of all glass lites. Setting blocks shall be heat cured silicone rubber with a hardness of 80 to 90 durometer, Shore A, a minimum length of 4" and a minimum width, which will permit full support of both panes of glass in an insulating glass unit or a monolithic unit no matter how positioned within the glazing rabbet. Location of setting blocks at glass quarter points is acceptable. Distance from vertical glass edge to nearest edge of setting block shall not be less than six inches.
    - b. Shims used in conjunction with setting blocks must be of the same materials, hardness, length and width as the setting blocks.
  - 2. Back-bedding tapes, expanded cellular glazing tapes, toe beads, heel beads and cap beads shall meet the requirements of applicable specifications cited in AAMA 800.
  - 3. Glazing gaskets shall be non-shrinking, weather-resistant, and compatible with all materials in contact.
  - 4. Structural silicone sealant where used shall meet the requirements of ASTM C1184.
  - 5. All materials and finishes in contact with structural silicone shall be tested for compatibility and approved by the sealant manufacturer for the intended application.
  - 6. Gaskets in continuous contact with structural silicone shall be extruded silicone or compatible material.
  - 7. Provide extruded aluminum setting block chairs for support of triple insulating glass.
- Z. Steel Components
  - 1. Provide steel reinforcements as necessary to meet the performance requirements of 1.03.
  - 2. Concealed steel anchors and reinforcing shall be factory painted after fabrication with TGIC powder coating, or rust-inhibitive primer complying with Federal Specification TT-P-645B.
  - 3. Anchors: Three way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer. CM to confirm tolerance in building structure.
  - 4. Dissimilar Metal Separation: Separate dissimilar metals with bituminous paint or plastic shims.
  - 5. Bituminous Coatings: Cold-applied asphalt mastic compounded for 30 – mil thickness per coat.
  - 6. Strength of embedded anchors shall be developed by integral projections, welded deformed bars, or headed studs.
  - 7. Expansion bolts are acceptable at concrete.
  - 8. Self-drilling, self-threading screws are not acceptable. Screw in plugs and power actuated fasteners are not acceptable.

## 2.4 FABRICATION

- A. General Design and Fabrication Requirements
  - 1. Finish, fabricate and factory assemble curtainwall and window wall under the responsibility of one manufacturer, with units sized for ease of shipping, distribution and erection.
    - a. Systems using individual field fabricated or field assembled members are not acceptable, unless necessitated by shipping, distribution or erection constraints.
  - 2. Framing to be designed for glazing from the exterior.
  - 3. Provide interlocking male/female type vertical mullion "stack" joints at adjacent grid frame members with sharp, well-defined corners and flush sightlines.
  - 4. Conceal fasteners at vertical to horizontal main framing connections and at miscellaneous trim except as shown on architectural drawings or otherwise required.
  - 5. Fabricate to allow for thermal movement of materials when subjected to a temperature differential from  $-20^{\circ}\text{F}$  to  $+180^{\circ}\text{F}$  without damage.
  - 6. The curtainwall and window wall system shall be designed to accommodate a total of plus or minus  $\frac{1}{4}$ " inter-story vertical movement, including fabrication tolerance, without damage. *Project Structural Engineer to confirm inter-story movements.*
  - 7. System to be fully pressure-equalized at the interior plane of the glazing pocket with anchor penetrations and framing connection fasteners located inboard of the primary air seal.
    - a. Glazing pocket at each glass lite shall be compartmentalized.
- B. Glass Drainage
  - 1. Provide weep holes and/or drainage slots within glazing pockets to drain any condensation or accumulating water within the system to exterior.
- C. "Snap-On" Covers
  - 1. Snap-on covers applied to pressure plates shall show a sharp, uninterrupted exterior profile between expansion joints.
    - a. Allow for horizontal thermal expansion in cover and pressure plate joinery.
    - b. Make provision for drainage of snap-on covers.
    - c. Snap-on covers shall conceal pressure plate fasteners.
  - 2. Pin, seal, or otherwise secure exterior snap-on covers as necessary to prevent vertical settlement over time.
    - a. Follow manufacturer's instructions for installation of extended covers that may be subject to inadvertent window washer loads.
    - b. Exterior snap trim to be mechanically fastened. Do not rely solely on snap engagement.
- D. Dual Glazed Access Panel
  - 1. Hinged access panel will be constructed with mitered corners, mechanically staked over a solid aluminum corner block leaving hairline joinery.
- E. Thermal Break Construction
  - 1. "Tri-level" framing system thermal isolation to be provided by:
    - a. Rigid cPVC thermal clips separating exterior surfaces from glazing pressure plates.
    - b. Continuous extruded EPDM 70 spacer separating pressure plates and frames.
    - c. Two strips of continuous pultruded 6/6 polyamide nylon with 25% glass fiber reinforcing providing  $\frac{7}{8}$ " thermal separation within glazing pocket.
    - d. Provide sponge neoprene zone dams at framing intersection.

- F. Weather-Stripping
  - 1. Dual durometer PVC, polypropylene, TPE, EPDM, neoprene, silicone, or other suitable material as tested and approved by the curtainwall manufacturer.
  - 2. Weather-stripping installed in integral dovetail races in framing members.
  - 3. One row of fin-type weather-strip at interlocking vertical mullion members to provide isolation for horizontal movement.

## 2.05 FINISHES

- A. Finish of Aluminum Components
  - 1. Finish of all exposed areas of aluminum curtainwall and window wall components shall be done in accord with the appropriate AAMA Voluntary Guide Specification shown.

Designation	Description	Standard	Color
AAM10C21A41	Clear Class I Eco-friendly etch	AAMA 611	Clear

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Site Verification of Conditions
  - 1. Verify that building substrates permit installation of curtainwall according to the manufacturer's instructions, approved shop drawings, calculations and contract documents.
  - 2. Do not install curtainwall until unsatisfactory conditions are corrected.

### 3.2 INSTALLATION

- A. Erection of Aluminum Curtainwall
  - 1. Install curtainwall with skilled workers in accordance with approved shop drawings, installation instructions, specifications, and the AAMA MCWM-1 "Metal Curtainwall Manual".
  - 2. Curtainwall must be installed plumb, square and level for proper weathering and operation.
  - 3. Aluminum that is not organically coated shall be insulated from direct contact with steel, masonry, concrete or other dissimilar metals by bituminous paint, rust-inhibiting primer, non-conductive shims or other suitable insulating material.
  - 4. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint
  - 5. Anchorage: After system components are positioned, fix connections to building structure as indicated on Shop Drawings.
    - a. Provide separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
    - b. Provide means for back-off prevention such as lock washer or spot welding. No liquid thread locks shall be permitted.
    - c. Anchor component parts by bolting and welding. Install slip pads between moving parts.
    - d. Where slots or oversized holes are provided for adjustment only, secure connection after final adjustment. Interlocking serrations in extruded aluminum brackets and washers are preferred. Steel weld washers with 0.25 inch minimum thickness are acceptable with steel brackets.

- e. Remove temporary shims and fasteners. Leave expansion joints free to move as designed.
- 6. Glazing:
  - a. Install glazing according to approved Shop Drawings and approved field-glazing requirements. Glaze in temperatures above 40 degrees F. Comply with GANA glazing manual.
  - b. Inspect frame for proper dimensions and squareness. Adjust frame and/or glass size as required to meet specified requirements.
  - c. Clean glazing pocket before setting glass. Solvents shall be with finished aluminum, glass and glazing materials. Setting blocks shall be equidistant from glass centerline. Location of setting blocks at glass quarter points is acceptable. Distance from vertical glass edge to nearest edge of setting block shall not be less than six inches.
  - d. Where gasket joints occur, tightly butt ends and seal with compatible sealant. Gasket joints shall not occur at locations other than corners if their use is permitted.
  - e. Inspect glass before installation. Do not install glass which does not conform to specification. Replace glass that is broken or damaged.
  - f. Except as otherwise specified, comply with GANA Glazing Manual.
  - g. Clean, prime and mask structural silicone joints during same day in which silicone is applied.
  - h. Temporarily clamp glass during cure of structural silicone. After sufficient cure, remove clamps and fill gaps in silicone.
  - i. Mask glass and aluminum during application of structural silicone. Remove masking immediately after tooling sealant.
  - j. Structural silicone shall not be applied to edges of insulating glass units, or to edges of laminated glass units. Sealants used as weather seals shall not be placed against edge of laminated glass interlayer.
- 7. Clean surfaces to be sealed. Install backer, primers and sealant according to approved Shop Drawings, sealant test results and manufacturer's recommendations. Tool sealant after application. Immediately remove masking. Comply with requirements of Section 079200, "Joint Sealants."
- 8. Install firesafing in locations indicated. Comply with requirements of Section 078413, "Firestops and Smoke-seals." And Engineering Judgments.
- 9. Erection Tolerances: Install glazed aluminum curtain wall system to comply with the following maximum tolerances:
  - a. Plumb: 1/16 inch in 10 feet; 1/8 inch in 40 feet.
  - b. Level: 1/16 inch in 20 feet; 1/8 inch in 40 feet.
  - c. Alignment: Where surfaces about in line, limit offset from true alignment to 1/16 inch; where a reveal or protruding element separates aligned surfaces by less than 2 inches, limit offset to 1/4 inch.
  - d. Location: Limit variation from plane or location shown on Shop Drawings to 1/8 inch in 12 feet; 1/4 inch over total length.

END OF SECTION



SECTION 08 58 00  
ALUMINUM INTERIOR SLIDING SERVICE WINDOW

PART 1 – GENERAL

1.1 SUMMARY

- A. This section includes:
  - 1. Aluminum, medium-duty interior sliding service windows as indicated in drawings and in sections.

1.2 SUBMITTALS

- A. Product Data: Submit Manufacturer's technical product data substantiating that products comply.
- B. Shop drawings: Submit for fabrication and installation of windows. Include details, elevations and installation requirement of finish hardware and cleaning.
- C. Certification: Provide printed data in sufficient detail to indicate compliance with the contract documents.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver windows crated to provide protection during transit and job storage.
- B. Inspect windows upon delivery for damage. Unless minor defects can be made to meet the Architect's specifications and satisfaction, damaged parts should be removed and replaced.
- C. Store windows at building site under cover in dry location.

1.4 PROJECT CONDITIONS

- A. Field measurements: Check opening by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.5 WARRANTY

- A. All material and workmanship shall be warranted against defects for a period of one (1) year from the original date of purchase.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER'S

- A. Basis of design: Design is based on aluminum, interior sliding service window manufactured by C.R. Laurence Co., Inc. (800) 421-6144

2.2 MATERIALS

- A. Frames: Aluminum frame modules shall be constructed of 6063-T5 extruded aluminum. Window rolls on top-hung ball bearing rollers. Catch locks included with all interior windows. Overall frame sizes are to be in accordance with the contract drawings.

- B. Finish: All aluminum to be clear anodized, or duranodic bronze.
- C. Glazing: The glazing vinyl supplied is for 1/8", 3/16", 7/32" or 1/4" in thickness. (specify glazing thickness to be used) Glass not included, to be supplied by others.
- D. Options: Keyed lock, full bottom track, screen. (Screen option not available on all units.) D4, D6, D7 & D1670 Overhead track. (Please specify)
- E. Models: Florence (OX or XO), Daisy (XX), Fawn (XOX), Barbara (OXO), Arlene (XOX), and Diane (OXXO). X = sliding panel, O = fixed panel, as viewed from clerks side.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Install window in accordance with manufacturer's printed instructions and recommendations. Repair damaged units as directed (if approved by the manufacturer and the architect) or replace with new units.

#### 3.2 CLEANING

- A. Clean frame and glazing surfaces after installation, complying with requirements contained in the manufacturer's instructions. Remove excess glazing sealant compounds, dirt or other substances.

#### 3.3 PROTECTION

- A. Institute protective measures required throughout the remainder of the construction period to ensure that all the windows do not incur any damage or deterioration, other than normal weathering, at the time of acceptance.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Sliding doors.
  - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Electromechanical door hardware.
  - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
  - 1. Section 08 06 71 - Door Hardware Sets
  - 2. Section 08 11 13 - Hollow Metal Frames
  - 3. Section 08 21 00 - Flush Wood Doors
  - 4. Section 08 41 00 - Aluminum Framed Storefronts
  - 5. Section 28 13 00 - Access Control
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series
  - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    - b. Complete (risers, point-to-point) access control system block wiring diagrams.
    - c. Wiring instructions for each electronic component scheduled herein.
  2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

- F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers are to be factory trained, certified prior to project bid, and a direct purchaser of the specified product. Installers are to be factory trained, certified prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
  - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  - 1. Function of building, purpose of each area and degree of security required.
  - 2. Plans for existing and future key system expansion.
  - 3. Requirements for key control storage and software.
  - 4. Installation of permanent keys, cylinder cores and software.
  - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s),

Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

#### 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
  - 1. Ten years for mortise locks and latches.
  - 2. Five years for exit hardware.
  - 3. Twenty five years for manual surface door closer bodies.
  - 4. Two years for electromechanical door hardware.

## 1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
  - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

### 2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
  - 1. Quantity: Provide the following hinge quantity:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.

- d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
  2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
  3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
  4. Hinge Options: Comply with the following:
    - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
  5. Manufacturers:
    - a. Bommer Industries (BO).
    - b. Lawrence Brothers (LA).
    - c. McKinney Products (MK).
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
  1. Manufacturers:
    - a. Markar Products (MR).
    - b. McKinney Products (MK).
    - c. Pemko Products (PE).

## 2.3 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
  1. Manufacturers:
    - a. Bommer Industries (BO) - (# wires) Option.
    - b. Lawrence Brothers (LA) - (# wires) Option.
    - c. McKinney Products (MK) - QC (# wires) Option.
- B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
  1. Manufacturers:
    - a. Architectural Builders Hardware (AH) - PT1000-EZ Series.
    - b. Pemko Products (PE) - EL-CEPT Series.
    - c. Securitron (SU) - EL-CEPT Series.



- C. Electrified Quick Connect Data Transfer Hinges: Provide combined electrified power and Ethernet data transfer hinges with Molex™ standardized plug connectors to accommodate Electrified Quick Connect Data Transfer Hinges: Provide combined electrified power and Ethernet data transfer hinges with Molex™ standardized plug connectors to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
1. Data transfer hinges feature two 6-position and two 4-position Molex connectors, 9 multi-strand wires; 2 twisted pairs (26 AWG), 4 straight conductors (28 gauge) and 1 straight conductor (22 AWG) with concealed plug connectors eliminating the need for separate or exposed wiring. Rated 350 mA continuous @ 48 volts DC nominal, the hinge is capable of two PoE wiring configurations:
    - a. Power over Data (5 wire): Power and Data supplied together over the 2 twisted 26 AWG) pairs. The 22 AWG conductor is used for the earth ground connection.
    - b. Data with Power over Spares (9 wire): Data over 2 twisted (26 AWG) pairs with Power over spare pairs 94 straight 28 AWG conductors). The 22 Awg conductor is used for earth ground connection.
  2. Manufacturers:
    - a. Bommer Industries (BO) - PoE Series.
    - b. Lawrence Brothers (LA) - PoE Series.
    - c. McKinney Products (MK) - PoE Series.
- D. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
1. Provide one each of the following tools as part of the base bid contract:
    - a. McKinney Products (MK) - Electrical Connecting Kit: QC-R001.
    - b. McKinney Products (MK) - Connector Hand Tool: QC-R003.
  2. Manufacturers:
    - a. McKinney Products (MK) - QC-C Series.
    - b. McKinney Products (MK) - PoE Series.
- E. Provide mortar guard enclosure on steel frames installed at masonry openings for each electrical hinge specified.

## 2.4 DOOR OPERATING TRIM

- A. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
  2. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
  3. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
  4. Manufacturers:

- a. Hiawatha, Inc. (HI).
- b. Rockwood Products (RO).
- c. Trimco (TC).

## 2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
  1. Manufacturers:
    - a. Corbin Russwin Hardware (RU).
    - b. To Meet Owners Requirements.
- C. Cylinders: Original manufacturer cylinders complying with the following:
  1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
  2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  3. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  4. Keyway: Match Facility Standard.
- D. High Security Cylinders: ANSI/BHMA A156.5, Grade 1, patterned high security cylinders and keys able to be used together under the same facility master or grandmaster key system. Provide UL437 certified high security cylinders, employing a patterned locking mechanism requiring the use of a patterned key and pick resistance; cylinders are to be factory keyed.
  1. Manufacturers:
    - a. Corbin Russwin (RU) - Pyramid PHS Series.
- E. Keying System: Each type of lock and cylinders to be factory keyed.
  1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
  2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  3. Existing System: Key locks to Owner's existing Corbin Russwin Pyramid system.
- F. Key Quantity: Provide the following minimum number of keys:
  1. Change Keys per Cylinder: Three (3) each.
  2. Master Keys (per Master Key Level/Group): Five (5) each.
  3. Construction Keys: Ten (10) each.
- G. Construction Keying: Provide construction master keyed cylinders.
- H. Key Registration List (Bitting List):
  1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  2. Provide transcript list in writing or electronic file as directed by the Owner.

## 2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
  - 1. Manufacturers:
    - a. Corbin Russwin Hardware (RU) - ML2000 Series.
    - b. To Meet Owners Requirements.

## 2.7 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
  - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  - 2. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- B. Standards: Comply with the following:
  - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.

## 2.8 ELECTRIC STRIKES

- A. Standard Electric Strikes: Heavy duty, cylindrical and mortise lock electric strikes conforming to ANSI/BHMA A156.31, Grade 1, UL listed for both Burglary Resistance and for use on fire rated door assemblies. Stainless steel construction with dual interlocking plunger design tested to exceed 3000 lbs. of static strength and 350 ft-lbs. of dynamic strength. Strikes tested for a minimum 1 million operating cycles. Provide strikes with 12 or 24 VDC capability and supplied standard as fail-secure unless otherwise specified. Provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike where specified.
  - 1. Manufacturers:
    - a. Folger Adam EDC (FO).
    - b. HES (HS).
    - c. Security Door Controls (SD).
- B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

## 2.9 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
  - 1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
  - 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
5. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
6. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
7. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
  - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
  - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
8. Extended cycle test: Devices to have been cycle tested in ordinance with ANSI/BHMA 156.3 requirements to 9 million cycles.
9. Rail Sizing: Provide exit device rails factory sized for proper door width application.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:
  - a. Corbin Russwin Hardware (RU) - ED5000 Series.
  - b. Sargent Manufacturing (SA) - 80 Series.
  - c. Yale Locks and Hardware (YA) - 7000 Series.

## 2.10 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

- B. Exterior Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.
1. Manufacturers:
    - a. Corbin Russwin Hardware (RU) - DC8000 Series.
    - b. Norton Door Controls (NO) - 9500 Series.
    - c. Sargent Manufacturing (SA) - 281 Series.
- C. Interior Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Manufacturers:
    - a. Corbin Russwin Hardware (RU) - DC6000 Series.
    - b. Norton Door Controls (NO) - 7500 Series.
    - c. Sargent Manufacturing (SA) - 351 Series.
- D. Interior Door Closers, Surface Mounted (Cam Action): ANSI/BHMA 156.4, Grade 1 certified surface mounted, high efficiency door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be of the cam and roller design, one piece cast aluminum silicon alloy body with adjustable backcheck and independently controlled valves for closing sweep and latch speed.
1. Manufacturers:
    - a. Corbin Russwin (RU) - DC5000 Series.
    - b. Norton Door Controls (NO) - 2800ST Series.
    - c. Sargent Manufacturing (SA) - 422 Series.

## 2.11 ARCHITECTURAL TRIM

- A. Door Protective Trim
1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
  2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
  3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
  4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
    - a. Stainless Steel: 300 grade, 050-inch thick.
  5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
  6. Manufacturers:
    - a. Hiawatha, Inc. (HI).
    - b. Rockwood Products (RO).

- c. Trimco (TC).

## 2.12 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  - 1. Manufacturers:
    - a. Hiawatha, Inc. (HI).
    - b. Rockwood Products (RO).
    - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
  - 1. Manufacturers:
    - a. Rixson Door Controls (RF).
    - b. Rockwood Products (RO).
    - c. Sargent Manufacturing (SA).

## 2.13 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

- F. Manufacturers:
  - 1. National Guard Products (NG).
  - 2. Pemko Products (PE).
  - 3. Reese Enterprises, Inc. (RE).

## 2.14 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
  - 1. Manufacturers:
    - a. Sargent Manufacturing (SA) - 3280 Series.
    - b. Security Door Controls (SD) - DPS Series.
    - c. Securitron (SU) - DPS Series.
- B. Switching Power Supplies: Provide switching power supplies that are dual voltage, UL listed, supervised units. Units shall be field selectable with a dedicated battery charging circuit that provide 4 Amp at 12VDC or 24VDC continuous, with up to 16 independently controlled power limited outputs. Units shall tolerate brownout or overvoltage input  $\pm 15\%$  of nominal voltage and have thermal shutdown protection with auto restart. Circuit breaker shall protect against overcurrent and reverse battery faults and units shall be available with a single relay fire trigger or individually triggered relayed outputs. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
  - 1. Manufacturers:
    - a. Securitron (SU) - AQ Series.

## 2.15 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.16 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## 2.17 EXISTING HARDWARE

- A. All hardware for doors listed as existing to remain in the door schedule or in the hardware sets will remain. The general contractor shall clean and adjust these items for proper alignment and operation.

## 2.18 EXISTING HARDWARE PREPS

- A. The general contractor shall verify that all new hardware specified for existing doors and frames will be compatible with the existing hardware preparations and conditions. Lack of verification prior to bid, that requires additional work to the existing doors and frames or additional material, will be the responsibility of the general contractor.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.



- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. Refer to Section 08 06 71 - Door Hardware Sets for hardware sets.

END OF SECTION

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SECTION 08 80 00  
GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes glazing products, including those specified in other Sections where glazing requirements are specified by reference to this Section as required by Contract Documents.

1.2 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
  - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
    - a. Design Wind Loads: Determine design wind loads applicable to project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Contract Drawings.
    - b. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
      - 1) For monolithic-glass lites heat treated to resist wind loads.
      - 2) For insulating glass.

- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
  - 1. For monolithic-glass lites, properties are based on units with lites 1/4 inch thick.
  - 2. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
    - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
    - b. Solar Heat Gain Coefficient: NFRC 200.
    - c. Solar Optical Properties: NFRC 300.

#### 1.4 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated including performance data for glass.
- B. Samples: For the following products, in the form of 12-inch- square Samples for glass.
  - 1. Each color of float glass.
  - 2. Wired glass.
  - 3. Insulating glass for each designation indicated.
- C. Glazing Schedule: Use same designations indicated on Contract Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- D. Generally retain paragraph and subparagraph below unless types of glass selected do not require labeling by authorities having jurisdiction or if certification is required as well as labels. See Evaluations.
- E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
  - 1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- F. Warranties: Special warranties specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this project; whose work has resulted in glass installations with a record of successful in-service performance.
- B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float and insulating glass.
- C. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- D. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

- E. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.
  - 1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
  - 2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
- F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. GANA Publications: GANA's "Glazing Manual."
  - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
- G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
  - 1. Insulating Glass Certification Council.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

#### 1.8 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to the Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project Site, within specified warranty period indicated below.
  - 1. Warranty Period: 5 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to the Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project Site, within specified warranty period indicated below.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, manufacturers specified.

### 2.2 GLASS PRODUCTS

- A. Type GL-1: Insulated Exterior Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 “Insulating-Glass Units” Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 “Performance Requirements” Article.
  2. Provide King FT (fully tempered) glass lites where safety glass is indicated.
  3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit’s edge.
  4. Sealing System: Dual seal, with primary and secondary sealants as follows:
    - a. Manufacturer’s standard sealants.
  5. Spacer Specifications: Manufacturer’s standard spacer material and construction.
- B. Type GL-2: Insulated Exterior Glass Units (Tempered), General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 “Insulating-Glass Units” Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 “Performance Requirements” Article.
  2. Provide King FT (fully tempered) glass lites where safety glass is indicated.
  3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit’s edge.
  4. Sealing System: Dual seal, with primary and secondary sealants as follows:
    - a. Manufacturer’s standard sealants.
  5. Spacer Specifications: Manufacturer’s standard spacer material and construction.
- C. Type GL-3: Insulated Exterior Glass Units (Spandrel); similar to Types GL-1 and GL-2 with outer lite of ¼” spandrel coated glazing. Color as selected by Owner/Architect from manufacturer’s full range.
- D. Type GL-4: NOT USED
- E. Type GL-5: NOT USED
- F. Type GL-6: Safety Glass - Clear; fully tempered; conforming to ANSI A97.1 and CPSC 95CRF (1201); ¼ inch thick minimum.
- G. Type GL-6A: Safety Glass - Clear; fully tempered; conforming to ANSI A97.1 and CPSC 95CRF (1201); ½ inch thick minimum.

- H. Type GL-7: Safety Glass – Frosted; fully tempered; conforming to ANSI A97.1 and CPSC 95CRF (1201); ¼ inch thick minimum.
- I. Type GL-8: NOT USED
- J. Type GL-9: NOT USED
- K. Type GL-10: ½” Laminated Safety Glass – Two lites of clear annealed glass, ¼” thick with clear 0.030” Saflex interlayer by Solutia. Laminate shall comply with CPSC 16 CFR 1201 Category I and Safety Glazing Test Standard and ANSI A-97.1-1984. Minimum standards specified in ASTM C1036-85 or C1048-85.

## 2.3 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
  - 1. Neoprene, ASTM C 864.
  - 2. EPDM, ASTM C 864.
  - 3. Silicone, ASTM C 1115.
  - 4. Thermoplastic polyolefin rubber, ASTM C 1115.
  - 5. Any material indicated above.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
  - 1. Neoprene.
  - 2. EPDM.
  - 3. Silicone.
  - 4. Thermoplastic polyolefin rubber.
  - 5. Any material indicated above.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

## 2.4 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
  - 1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

## 2.5 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

## 2.6 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- C. Grind smooth and polish exposed glass edges and corners.

## 2.7 MONOLITHIC FLOAT-GLASS UNITS

- A. Uncoated Clear Float-Glass Units: Class 1 (clear) annealed or Kind HS (heat-strengthened) float glass where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with system performance requirements.
  - 1. Thickness: 1/4" thick minimum.

## 2.8 MONOLITHIC WIRED-GLASS UNITS

- A. Polished Wired-Glass Units (Type G-14): Form 1 (wired glass, polished both sides), Quality-Q6, Mesh 1 (Diamond), 1/4 inch thick.
  - 1. Available Manufacturers:
    - a. Asahi/AMA Glass Corp.; affiliated with AFG Industries, Inc.
    - b. Central Glass Co., Ltd.; distributed by Northwestern Industries Inc.
    - c. Pilkington Sales (North America) Ltd.
    - d. Substitutions: Or approved equal.

## 2.9 INSULATING-GLASS UNITS

- A. Tinted Insulating-Glass Units (Types GL-1 & GL-2):
  - 1. Acceptable Manufactures:
    - a. PPG – Solarban 70XL – Atlantica (Basis of Design).
    - b. Oldcastle.
    - c. Guardian.
    - d. Pilkington.
    - e. Substitutions: Or approved equal.
  - 2. Overall Unit Thickness and Thickness of Each Lite: 1/4 inch minimum individual glass lite thickness with an overall unit thickness of 1 inch.
  - 3. Interspace Content: Air or Argon.
  - 4. Outdoor Lite: Class 1 float glass.
  - 5. Indoor Lite: Class 1 (clear) float glass.
    - a. Kind HS (heat strengthened).
  - 6. Low-E Coating: Pyrolytic or sputtered on second or third surface.
  - 7. Visible Light Transmittance: 450 percent minimum.
  - 8. Summer Daytime U-Factor: 0.26 maximum.
  - 9. Solar Heat Gain Coefficient: 0.24 maximum.
  - 10. Shading Coefficient: 0.28 minimum.
  - 11. Ultra Violet: 2 percent.



## 2.10 SAFETY GLASS (Type G-6)

- A. 1/4" Safety Glass (G-6): heat strengthened clear safety glass.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep system.
  - 3. Minimum required face or edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Contract Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project Site and legally dispose of off Project Site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### 3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### 3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.7 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

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## COLOR SCHEDULE

Hagerstown Regional Airport ADCI  
Terminal Bldg Alterations-Addition  
BFM # 18045/1CA8  
December 17, 2018  
Updated 2/25/19

TYPE	MATERIAL	SECTION	LOCATION	MANUF.	STYLE	COLOR	NOTES
	<b>FLOORS</b>						
F1	Porcelain Tile	09 66 23	Waiting, Lobby, Baggage Claim, Rental, Concession, Ticket Counter, Security Screening, Hold Room Ramp	Atlas Concorde	Marvel Gems, Matt, 18 x 36	Color A (F1A)(Accent) Terrazzo White Matt, Color B (F1B)(Field): Terrazzo Gray Matt	2/22/19
F2	Porcelain Tile	09 31 00	Men's Public Restrooms, Women's Public Restrooms, Café	Daltile	Formula, 12" x 24" Unpolished	FM95 Intersection Anthracite	Grout: Mapei # 47 Charcoal
F3	Carpet Tile A	09 68 80	Hold Rooms	J & J Invision	Index 7008, 24" x 24", 1/4 Turn Install	1834 Version	
F4	Quartz Tile	09 65 00		UpoFloor	Mosaic Collection, 24" x 24"	619304	
F5	Carpet Tile B	09 65 00	Reception, Offices, Conference Room	J & J Invision	With a Twist 7080, 24" x 24", Monolithic Install	2469 Twist of Words	
F6	Walk Off Mat	09 68 80	Vestibules	J & J Invision	Catwalk II 7268, 24" x 24", 1/4 Turn Install	1428 Stike a Pose	
	<b>BASE</b>						
B1	Not Used						
B2	Porcelain Tile Base	09 31 00		Daltile	Formula Unpolished, 6" high x 12"	FM95 Intersection Anthracite	Grout: Mapei # 47 Charcoal

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## COLOR SCHEDULE

TYPE	MATERIAL	SECTION	LOCATION	MANUF.	STYLE	COLOR	NOTES
	<b>CEILINGS</b>						
C1	Acoustical Ceiling Tile - Type 1	09 51 10	General	Armstrong	Ultima # 1941, 2' x 2', 15/16" Beveled Tegal	White	
C2	Acoustical Ceiling Tile - Type 2	09 51 10	Restrooms	Armstrong	Pebble # 2988, Perforated 2' x 2', 15/16" Square Lay-In	White	
C3	Exposed						
C4	Gyp Bd - Painted	09 90 00		Sherwin Williams		SW7646 First Star	
C5	Clg Framework - Painted	09 90 00		Sherwin Williams		SW7071 Gray Screen	
C6	Metal Decking - Painted	09 51 00		Epic Metals (Metal) Sherwin Williams (Paint)	Toris A, 6' wide (Metal)	SW7071 Gray Screen (Paint)	
C7	Interior Existing Decking - Painted	09 90 00		Sherwin Williams		SW7071 Gray Screen	
C8	Acoustical Clg Tile - Type 3	09 51 00	Café	Armstrong	Optima Health Zone #3214PB, 2' x 2', 15/16" Square Tegal	White	
	<b>MISCELLANEOUS</b>						
M1	Wood Doors - Stained	08 21 00		TBD	TBD	TBD	
M2	Door Frames - Painted	09 90 00		Sherwin Williams		SW7076 Cyberspace	

## COLOR SCHEDULE

Hagerstown Regional Airport ADCI  
Terminal Bldg Alterations-Addition  
BFM # 18045/1CA8  
December 17, 2018  
Updated 2/25/19

TYPE	MATERIAL	SECTION	LOCATION	MANUF.	STYLE	COLOR	NOTES
M3	Toilet Partitions	10 17 00	Men's Public Restrooms, Women's Pubic Restrooms	Bobrick	Sierra Series	Mens: SC04 Forest Green Womens: SC02 Desert Beige	Ceiling Hung
M4	Millwork	06 20 00	Men's Public Restrooms, Women's Public Restrooms	Bradley	Evero Quartz Basin, Geo Series	Mykonos	
			Café Bar	Dupont Corian Quartz (Countertop) Formica Laminate (Cabinetry) Dupont Corian Solid Surface (Top of foot ledge) Porcelain Tile (Front of foot ledge)	Uniform Wood, 8" x 48" (Front of foot ledge)	Ctr - Cloud White Cab - 6437-58 Chalked Knotty Ash Top of foot ledge - Deep Titanium Front of foot ledge - UW 14 Medium Grey	
			Café Cabinetry - wall behind bar	Formica		912-58 Storm	
			141A Office, 142 Office, 132 TSA	Formica		Ctrtop - 6317-34 Weathered Cement Cab - 8841-WR White Ash	



## COLOR SCHEDULE

Hagerstown Regional Airport ADCI  
Terminal Bldg Alterations-Addition  
BFM # 18045/1CA8  
December 17, 2018  
Updated 2/25/19

TYPE	MATERIAL	SECTION	LOCATION	MANUF.	STYLE	COLOR	NOTES
			105 Rental, Concessions, Ticket Counters	Dupont Corian Quartz (Countertop) Formica Laminate (Cabinetry)		Ctrtop - Concrete Carrarra Cab - 8902-NG White Painted Wood	
			Charging Station Countertops	Dupont Corian Quartz		Cloud White	2/12/2019
M5	Sills - Solid Surface		All Areas	Dupont Corian Quartz		Cloud White	
M6	Wood Trim - Painted		Café - around clear Write & Erase Paint	Sherwin Williams		SW6991 Black Magic	
M7	Wood Trim - Stained		Restrooms	Sherwin Williams		TBD	
M8	Carpet - Broadloom		Temporary Waiting Room during phasing	J & J Invision	Passages 3036, 12' Width	2046 Channel	2/25/2019

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SECTION 09 11 10  
METAL STUD FRAMING SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Formed metal stud framing at interior locations.
- B. Framing accessories.

1.2 RELATED SECTIONS

- A. Section 06 11 40 – Wood blocking and Curbing: Framing, sheathing and rough wood blocking.
- B. Section 07 21 00 – Thermal Insulation.
- C. Section 07 90 00 - Joint Protection.
- D. Section 09 26 00 - Gypsum Board Systems: Metal studs for partitioning.

1.3 REFERENCES

- A. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. ASTM A653/A653M-08 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- C. ASTM A924 - Steel Sheet, Cold-Rolled, Electrolytic Zinc-Coated.
- D. ASTM A1003 – Standard Specification for Sheet Steel, Carbon, Metallic and Nonmetallic-Coated for Cold-Formed Framing Members.
- E. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track) and Rigid Furring Channels for Screw Application of Gypsum Board.
- F. ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board.
- G. GA 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum Board.
- H. Metal Framing Manufacturers Association (MFMA) - Guidelines for the Use of Metal Framing.
- I. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.4 SYSTEM DESCRIPTION

- A. Metal stud framing system for interior walls, with batt type acoustic insulation specified in Section 07 21 00, and interior gypsum board specified in Section 09 26 00.
- B. Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with code.
- C. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

## 1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate component details, anchorage to structure, type and location of fasteners, and accessories or items required of other related work.
- C. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement to framing connections.
- D. Product Data: Provide data describing standard framing member materials and finish, product criteria, load charts, and limitations.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

## 1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with GA 203 and ASTM C754.
- B. Maintain one copy of each document on site.

## 1.7 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this section with minimum five years documented experience.

## 1.8 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.
- B. Coordinate with the placement of components within the stud framing system, specified in Section 06 11 40 and Divisions 22, 23, 26, 27, and 28.

# PART 2 PRODUCTS

## 2.1 STUD FRAMING MATERIALS

- A. Studs: Meeting requirements of ASTM C645; C-Channel, roll-formed from hot-dipped galvanized steel; complying with ASTM A1003 and ASTM A653 G40 or equivalent corrosion resistant coating, depth as detailed:
  - 1. Subject to compliance with requirements, provide ClarkDietrich ProSTUD Framing (20 gauge equivalent).
    - a. ClarkDietrich ProSTUD Fire rated partitions to be installed in accordance with UL V450, V438, or V419.
  - 2. Thickness: Interior - 20 gauge.
- B. Runners: Of same material and thickness as studs.
- C. Deflection Track Slotted: Manufacturer's single, deep-leg, U-shaped steel track: punched with vertical slots in both legs. Steel Sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection from structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  - 1. Subject to compliance with requirements, provide: ClarkDietrich MaxTrak or BlazeFrame Slotted Deflection Track or equivalent.

- D. Channel Bridging or Bracing: U-Channel Assembly; Base metal thickness of .0538 inch and minimum ½ inch wide flanges.
  - 1. Subject to compliance with requirements, provide ClarkDietrich Spazzer 9200 Bridging and Bracing Bar.
  - 2. U-Channel Assembly: 1 ½ inches
    - a. ClarkDietrich Metal Framing; Easy Clip U-Series Clip Angle or equivalent.
- E. Furring and Bracing Members: Of same material as studs; thickness to suit purpose.
- F. Fasteners: GA 203. Self drilling, self tapping screws.
- G. Sheet Metal Backing: 18 gage galvanized steel for reinforcement.
- H. Anchorage Devices: Power actuated. Drilled expansion bolts. Screws with sleeves.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC - Paint 20 Type I Inorganic zinc rich.

## 2.2 FABRICATION

- A. Fabricate assemblies to sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.
- B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

## 2.3 FINISHES

- A. Studs and Track: Galvanize to G60 (minimum) coating class.
- B. Headers: Galvanize to G60 coating class.
- C. Accessories: Same finish as framing members. ASTM A123, hot dip galvanized to 1.25 oz/sq ft.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 31 00.
- B. Verify that conditions are ready to receive work.
- C. Verify that rough-in utilities are in proper location.

### 3.2 ERECTION

- A. Installation Standard: Comply with ASTM C 754
- B. Align and secure top and bottom runners at 24 inches oc.
- C. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- D. Install studs vertically at 16 inches oc.
- E. Align stud web openings horizontally.
- F. Secure studs to tracks using crimping method. Do not weld.

- G. Stud splicing not permissible.
- H. Fabricate corners using a minimum of three studs.
- I. Double stud at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.
- J. Brace stud framing system rigid.
- K. Coordinate erection of studs with requirements of door frames, window frames, and markerboards, chalkboards and tackboards; install supports and attachments.
- L. Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.
- M. Blocking: Secure wood blocking to studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and chalkboards, markerboards and tackboards.
- N. Refer to Drawings for indication of partitions extending to finished ceiling only and for partitions extending through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
- O. Coordinate placement of insulation in stud spaces made inaccessible after stud framing erection.

END OF SECTION

SECTION 09 26 00  
GYPSUM BOARD SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Interior gypsum board.
  - 2. Tile backing panels.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.4 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.1 PANELS, GENERAL

- A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. G-P Gypsum.
  - b. Lafarge North America Inc.
  - c. National Gypsum Company.
  - d. USG Corporation.
- B. Regular Type:
  1. Thickness: 5/8 inch.
  2. Long Edges: Tapered.
  3. Not used.
- C. Type X:
  1. Thickness: 5/8 inch.
  2. Long Edges: Tapered.
  3. Standard unless noted otherwise.
- D. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
  1. Thickness: 5/8 inch.
  2. Long Edges: Tapered.
  3. Typical at ceilings.
- E. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.
  1. Core: Type X.
  2. Long Edges: Tapered.
  3. Not used.
- F. High-Impact Type: Manufactured with Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance).
  1. Core: 5/8 inch thick.
  2. Plastic-Film Thickness: 0.010 inch.
  3. Not used.
- G. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
  1. Core: 5/8 inch, Type X.
  2. Long Edges: Tapered.
  3. All bathrooms and wet areas.

## 2.3 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board:
  1. Complying with ASTM C 1178/C 1178M.
    - a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum.
  2. Complying with ASTM C1177/C 1177M.
    - a. Product: Subject to compliance with requirements, provide "DensArmor Plus Interior Guard" by G-P Gypsum.
  3. Core: 5/8 inch, Type X.
  4. At all locations receiving tile.

## 2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.



1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
  2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.
    - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fry Reglet Corp.
    - b. Gordon, Inc.
    - c. Pittcon Industries.
  2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
  3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

## 2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
1. Interior Gypsum Wallboard: Paper.
  2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
  3. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
  3. Fill Coat: For second coat, use drying-type, all-purpose compound.
  4. Finish Coat: For third coat, use drying-type, all-purpose compound.
  5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
  2. Cementitious Backer Units: As recommended by backer unit manufacturer.

## 2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Acoustical Sealant: As specified in Section 07 90 00 - Joint Protection.
- E. Thermal Insulation: As specified in Section 07 21 00 - Board Insulation.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
  1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
  2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
  3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- B. Multilayer Application:
  1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
  2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
  3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
  4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- C. Curved Surfaces:
  1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch long straight sections at ends of curves and tangent to them.
  2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

### 3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
  1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
  2. Fasten with corrosion-resistant screws.

### 3.5 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

### 3.6 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Professional for visual effect.
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners, unless otherwise indicated.
  - 2. U-Bead: Use at exposed panel edges.
  - 3. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

### 3.7 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Provide the following level of finish in accordance with the Gypsum Construction Handbook – Latest Edition.
  - 1. Level of Finish Schedule:
    - a. Level 0 – Temporary Construction.
    - b. Level 1 – Plenum areas above ceilings or areas not exposed to view.
    - c. Level 2 – WR Gypsum backing board being used for tile substrate.
    - d. Level 3 – Gypsum board scheduled to relieve heavy textured finishes or commercial grade wall coverings.
    - e. Level 4 – Gypsum board scheduled to receive light textured finishes or residential grade wall coverings.
    - f. Level 5 – All gypsum board scheduled to receive paint finish.
- E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

### 3.8 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 09 30 00  
TILING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Porcelain tile.
  - 2. Ceramic tile.
  - 3. Marble thresholds.
  - 4. Crack-suppression membrane for thin-set tile installations.
  - 5. Metal edge strips installed as part of tile installations.

1.2 DEFINITIONS

- A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
- B. Facial Dimension: Actual tile size (minor facial dimension as measured per ASTM C 499).
- C. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.3 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
  - 1. Level Surfaces: Minimum 0.6.
  - 2. Step Treads: Minimum 0.6.
  - 3. Ramp Surfaces: Minimum 0.8.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- D. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- E. Product Certificates: For each type of product, signed by product manufacturer.
- F. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type from one source or producer.
  - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
  - 1. Stone thresholds.
  - 2. Joint sealants.
  - 3. Metal edge strips.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
- D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. As indicated in Part 2.
- B. Substitutions: Under provisions of Section 01 60 00.



## 2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
  - 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.  
Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
  - 1. As selected by Professional from manufacturer's full range.
- C. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
- E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

## 2.3 TILE PRODUCTS

- A. Ceramic Tile:
  - 1. Type W6
    - a. Manufacturer: Datile
    - b. Product: Elevare Glazed Ceramic
    - c. Size: 6" x 18" x 5/16"
- B. Porcelain Tile:
  - 1. Type F2
    - a. Manufacturer: Datile
    - b. Product: Formula Unpolished
    - c. Size: 12" x 24" x 7/16"
  - 2. Type W2
    - a. Manufacturer: Daltile
    - b. Product: Marble Attache Satin
    - c. Size: 12" x 24" x 3/8"
  - 3. Type F1 (A & B - See drawings)
    - a. Manufacturer: Atlas Concorde
    - b. Product: Marvel Gems Matt
    - c. Size: 18" x 36" x 3/8"
- C. Tile Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:

1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
  2. Shapes: As follows, selected from manufacturer's standard shapes:
    - a. Base: Coved.
    - b. Wainscot Cap for Thinset Mortar Installations: Surface bullnose.
    - c. External Corners for Thinset Installations: Surface bullnose.
    - d. Internal Corners: Field-buttet square corners, except use coved base and cap angle pieces designed to member with stretcher shapes.
- D. Accessories for Glazed Wall Tile: Provide vitreous china accessories of type and size indicated, in color and finish to match adjoining wall tile, and intended for installing by same method as adjoining wall tile.

## 2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch or less, and finish bevel to match face of threshold.
- B. Marble Thresholds: ASTM C 503 with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.
1. Description: Uniform, fine- to medium-grained white stone with gray veining.

## 2.5 CRACK-SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS

- A. General: Manufacturer's standard product that complies with ANSI A118.10, selected from the following.
- B. Chlorinated-Polyethylene-Sheet Product: Nonplasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric, for adhering to latex-portland cement mortar; 60 inches wide by 0.030-inch nominal thickness.
1. Available Product: Noble Company (The); Nobleseal TS.

## 2.6 SETTING AND GROUTING MATERIALS

- A. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
1. For wall applications, provide nonsagging mortar that complies with Paragraph C-4.6.1 in addition to the other requirements in ANSI A118.1.
- B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:
1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
  2. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.
    - a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.
- C. Polymer-Enriched Mortar Medium Bed and Thinnest (Tiles over 15"): ANIS A118.4 and A118.1 consisting of the following: (Equal to Mapei Ultraflex LFT)
1. Polymer-enriched for high performance and deformability.
  2. Non-sag formula for large-format tile and stone in wall applications.
  3. Non-slump for large-format tile and stone in floor applications. Can be used as a medium bed up to 3/4" thick.
  4. Smooth and creamy consistency makes it easy to apply.

- 5. Low-Dust Technology reduces dust by 90%, resulting in a cleaner and healthier application.
- D. Standard Sanded Cement Grout: ANSI A118.6, color as indicated.
- E. Standard Unsanded Cement Grout: ANSI A118.6, color as indicated.
- F. Polymer-Modified Tile Grout: ANSI A118.7, color as indicated.
  - 1. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
    - a. Unsanded grout mixture for joints 1/8 inch and narrower.
    - b. Sanded grout mixture for joints 1/8 inch and wider.
- G. Grout for PregROUTED Tile Sheets: Same silicone rubber used in factory to pregROUT tile sheets.

## 2.7 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."
  - 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
  - 1. Available Products:
    - a. Dow Corning Corporation; Dow Corning 786.
    - b. GE Silicones; Sanitary 1700.
    - c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
    - d. Tremco, Inc.; Tremsil 600 White.
- D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
  - 1. Available Products:
    - a. Bostik; Chem-Calk 550.
    - b. Mameco International, Inc.; Vulkem 245.
    - c. Pecora Corporation; NR-200 Urexpand.
    - d. Tremco, Inc.; THC-900.

## 2.8 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Protection: L-shape, height to match tile and setting-bed thickness, satin anodized aluminum finish. Equal to Schluer Systems 2.12-Indec.

- C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
  - 1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
  - 2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

## 2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
  - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
  - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
  - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
  - 2. Remove protrusions, bumps, and ridges by sanding or grinding.

- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

### 3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
  - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Refer to TCA's "Handbook for Ceramic Tile Installation" and to ANSI A108 Series of tile installation standards for data on expansion joints. Both require joint locations to be indicated on Drawings. There is no substitute for showing all joints on Drawings.
- H. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
  - 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- I. Grout tile to comply with requirements of the following tile installation standards:
  - 1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.
- J. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

### 3.4 CRACK-SUPPRESSION MEMBRANE INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
- B. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.
- C. Provide crack isolation sheets over the entire concrete subfloor to receive tile work.
- D. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

### 3.5 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
  - 1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
    - a. Tile floors composed of tiles 8 by 8 inches or larger.
    - b. Tile floors composed of rib-backed tiles.
- B. Joint Widths: Install tile on floors with 1/8 inch joint widths.
- C. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.
  - 1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.
- D. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

### 3.6 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Install metal lath and scratch coat for walls to comply with ANSI A108.1A, Section 4.1.
- C. Joint Widths: Install tile on walls with the following joint widths:
  - 1. Glazed Wall Tile: 1/16 inch.
  - 2. Glass Tile: 1/16 inch.

### 3.7 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove latex-portland cement grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

### 3.8 FLOOR TILE INSTALLATION SCHEDULE

- A. Tile Installation: Interior floor installation on concrete; thin-set mortar; TCA F113 and ANSI A108.5.
  1. Tile Type: Unglazed ceramic mosaic tile.
  2. Thin-Set Mortar: Dry-set portland cement mortar.
  3. Grout: Standard sanded cement grout.
- B. Tile Installation: Interior floor installation on crack-suppression membrane over concrete; thin-set mortar; TCA F122 and ANSI A108.5.
  1. Tile Type: Unglazed ceramic mosaic tile.
  2. Thin-Set Mortar: Latex-portland cement mortar.
  3. Grout: Polymer-modified sanded grout.

### 3.9 WALL TILE INSTALLATION SCHEDULE

- A. Tile Installation: Interior wall installation over sound, dimensionally stable masonry or concrete; thin-set mortar; TCA W202 and ANSI A108.5.
  1. Tile Type: Glazed wall tile.
  2. Thin-Set Mortar: Dry-set portland cement mortar.
  3. Grout: Standard unsanded cement grout.
- B. Tile Installation: Interior wall installation over gypsum board; thin-set mortar; TCA W243 and ANSI A108.5.
  1. Tile Type: Glazed wall tile.
  2. Thin-Set Mortar: Dry-set portland cement mortar.
  3. Grout: Standard unsanded cement grout.
- C. Tile Installation: Interior wall installation over cementitious backer units; thin-set mortar; TCA W244 and ANSI A108.5.
  1. Tile Type: Glazed wall tile.
  2. Thin-Set Mortar: Dry-set portland cement mortar.
  3. Grout: Standard unsanded cement grout.
- D. Tile Installation: Interior wall installation over glass-mat, water-resistant backer board; thin-set mortar; TCA W245 and ANSI A108.5.
  1. Tile Type: Glazed wall tile.
  2. Thin-Set Mortar: Dry-set portland cement mortar.
  3. Grout: Standard unsanded cement grout.

END OF SECTION

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SECTION 09 51 23  
ACOUSTICAL TILE CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Suspended metal grid ceiling system and perimeter trim.
- B. Acoustical tile.
- C. Non-fire rated assembly.

1.2 RELATED SECTIONS

- A. Division 22: Sprinkler heads in ceiling system.
- B. Division 23: Air diffusion devices in ceiling system.
- C. Division 26: Light fixtures in ceiling system.
- D. Division 28: Fire alarm components in ceiling system.

1.3 REFERENCES

- A. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- C. ASTM C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- D. ASTM E580 - Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
- E. ASTM E1264 - Classification of Acoustical Ceiling Products.
- F. Ceilings and Interior Systems Contractors Association (CISCA) - Acoustical Ceilings: Use and Practice.
- G. UL - Fire Resistance Directory and Building Material Directory.

1.4 SYSTEM DESCRIPTION

- A. Suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.
- C. Product Data: Provide data on metal grid system components, and acoustical units.

- D. Samples: Submit two samples 6 x 6 inch in size illustrating material and finish of acoustical units.
- E. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and edge trim.
- F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

## 1.6 QUALIFICATIONS

- A. Grid Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

## 1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable code for combustibility requirements for materials.

## 1.8 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

## 1.9 SEQUENCING

- A. Sequence work under the provisions of Section 01 31 00.
- B. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- C. Install acoustical units after interior wet work is dry.

## 1.10 EXTRA MATERIALS

- A. Furnish under provisions of Section 01 73 00.
- B. Provide 5 percent of total acoustical unit area of each type of extra tile to Owner.

# PART 2 PRODUCTS

## 2.1 MANUFACTURERS - SUSPENSION SYSTEM

- A. Specified Manufacturer: Armstrong.
- B. Other Acceptable Manufacturers:
  - 1. Chicago.
  - 2. Donn.
- C. Substitutions: Under provisions of Section 01 60 00.

## 2.2 SUSPENSION SYSTEM MATERIALS

- A. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed T paired access T; components die cut and interlocking.
  - 1. Use Armstrong's Prelude 15/16 inch w/Type 1 and Type 2 ceilings.
  - 2. Use Armstrong's Prelude Plus 15/16 inch w/Type 3 Ceiling.
- B. Grid Materials: Cold rolled steel.
  - 1. Prelude Plus 15/16 inch: Galvanized and coated steel with aluminum cap as required.
- C. Exposed Grid Surface Width: 15/16 inch.
- D. Grid Finish: color as selected.
- E. Accessories: Stabilizer bars clips splices edge moldings and hold down clips required for suspended grid system.
- F. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

## 2.3 MANUFACTURERS - ACOUSTICAL UNITS

- A. Specified Manufacturer: Armstrong
- B. Other Acceptable Manufacturers
  - 1. USG
  - 2. Celotex.
- C. Substitutions: Under provisions of Section 01 60 00.

## 2.4 ACOUSTICAL UNIT MATERIALS

- A. Acoustical Panels: (C1) – Ultima #1941 conforming to the following:
  - 1. Size: 24 x 24 inches
  - 2. Thickness: 7/8 inch
  - 3. Composition: wet form mineral fiber
  - 4. Density: 1.25 lbs/sf
  - 5. Light Reflectance: 0.87
  - 6. NRC Range: 0.80
  - 7. Fire Spread: Class A
  - 8. Edge: Beveled Tegalur
  - 9. Surface Color: White
  - 10. Surface Finish: Factory applied latex paint
  - 11. Suspension System: Prelude 15/16"
- B. Acoustical Panels: (C2): Pebble #2988 - conforming to the following:
  - 1. Size: 24 x 24 inches
  - 2. Thickness: 1 inch
  - 3. Composition: fiberglass with vinyl facing
  - 4. Density: .31 lbs/sf
  - 5. Light Reflectance: 0.89
  - 6. NRC Range: 0.80
  - 7. Flame Spread: Class A
  - 8. Edge: Square Lay-In
  - 9. Surface Color: White
  - 10. Surface Finish: Scrubbable vinyl film facing
  - 11. Suspension System: Prelude 15/16"

- C. Acoustical Panels: (C8): Optima Health Zone #3214PB - conforming to the following:
1. Size: 24 x 24 inches
  2. Thickness: 1 inch
  3. Composition: fiberglass with Durabrite scrim acoustically transparent membrane
  4. Density: .45 lbs/sf
  5. Light Reflectance: 0.86
  6. NRC Range: 0.95
  7. Flame Spread: Class A
  8. Edge: Square Tegular
  9. Surface Color: White
  10. Surface Finish: Durabrite factory applied latex paint
  11. Suspension System: Prelude Plus 15/16"

## 2.5 ACCESSORIES

- A. Touch-up Paint: Type and color to match acoustical and grid units.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 31 00.
- B. Verify that layout of hangers will not interfere with other work.

### 3.2 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

- A. Install suspension system in accordance with manufacturer's instructions and as supplemented in this section.
- B. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
- C. Locate system on room axis according to reflected plan.
- D. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
- E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
- H. Do not eccentrically load system or produce rotation of runners.
- I. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.
- J. Form expansion joints where required. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

### 3.3 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units one way with pattern parallel to shortest room axis in basket weave pattern. Fit border trim neatly against abutting surfaces.
- D. Install units after above ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp and dents.
- F. Cut tile to fit irregular grid and perimeter edge trim. Field rabbet tile edge. Double cut and field paint exposed edges of tegular units.
- G. Where bullnose concrete block corners round obstructions occur, provide preformed closers to match edge molding.
- H. Install hold-down clips to retain panels tight to grid system.

### 3.4 ERECTION TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

### 3.5 SCHEDULE

- A. Type C1: General
- B. Type C2: Restroom
- C. Type C8: Cafe

END OF SECTION

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SECTION 09 65 00  
RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Quartz tile.
- B. Vinyl cove base.

1.2 RELATED SECTIONS

- B. Section 03 30 00 - Cast-in-Place Concrete: Floor substrate surface.

1.3 REFERENCES

- A. ASTM E84 - Surface Burning Characteristics of Building Materials.
- B. FS L-F-1641 - Floor Covering, Translucent or Transparent Vinyl Surface, with Backing.
- C. FS L-F-475 - Floor Covering, Vinyl Surface (Tile and Roll), with Backing.
- D. FS RR-T-650 - Treads, Metallic and Non-metallic, Non-skid.
- E. FS SS-T-312 - Tile, Floor: Asphalt, Rubber, Vinyl, and Vinyl Composition.
- F. FS SS-W-40 - Wall Base: Rubber and Vinyl Plastic.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame/ fuel/smoke rating requirements of in accordance with ASTM E84.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Provide product data on specified products, describing physical and performance characteristics, sizes, patterns and colors available.
- C. Submit samples under provisions of Section 01 33 00.
- D. Submit two samples 3 x 3 inches in size, illustrating color and pattern for each floor material specified.
- E. Submit two 3 inch long samples of base material for each color specified.
- F. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

## 1.8 OPERATION AND MAINTENANCE DATA

- A. Submit cleaning and maintenance data under provisions of Section 01 78 20.
- B. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

## 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

## 1.10 EXTRA MATERIALS

- A. Provide 100 sq ft of each color of selected flooring and 1 coil of each base color of each material specified under provisions of Section 01 73 00.

## PART 2 PRODUCTS

### 2.1 QUARTZ TILE – OFFICE AT TICKET COUNTERS (F4)

- A. Quartz Tile: Equal to UpoFloor Quartz Mosaic Collection, 24” x 24”, 2.0 mm thick, ASTM F 1066. Color selected from manufacturer’s full line of samples.

### 2.2 Rubber BASE

- A. Rubber Base: Equal to Johnsonite Rubber Base, 4.25” high , millwork reveal profile. Color to be selected by Architect.

### 2.3 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Primers and Adhesives: Types recommended by flooring material manufacturer. Adhesive shall be equal to Armstrong S-89 or S-90 Resilient Tile Adhesive.
- C. Edge Strips: Flooring material.
- D. Transition Strips: Types and profiles recommended by flooring manufacturer. Colors as selected by Owner/Architect from manufacturer’s full range.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 ft and are ready to receive Work.



- B. Verify concrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.
- C. Beginning of installation means acceptance of substrate and site conditions.

### 3.2 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Apply, trowel, and float filler to leave a smooth, flat, hard surface.
- C. Prohibit traffic from area until filler is cured.
- D. Vacuum clean substrate.
- E. Apply primer to surfaces.

### 3.3 INSTALLATION - TILE MATERIAL

- A. Install in accordance with manufacturers' instructions.
- B. Mix tile from container to ensure shade variations are consistent.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Set flooring in place; press with heavy roller to attain full adhesion.
- E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile patterns.
- F. Install tile to square grid pattern with all joints aligned and with pattern grain parallel for all units and parallel to width of room. Allow minimum 1/2 full size tile width at room or area perimeter.
- G. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
- H. Install edge strips at unprotected or exposed edges, and where flooring terminates.
- I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- J. Install flooring in pan type floor access covers. Maintain floor pattern.
- K. Install flooring under movable partitions without interrupting floor pattern.
- L. Install feature strips, and floor markings where indicated. Fit joints tightly.

### 3.4 INSTALLATION - BASE MATERIAL

- A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

- B. Miter internal corners. At external corners, use premolded units. At exposed ends use premolded units.
- C. Install base on solid backing. Bond tight to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

### 3.5 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.

### 3.6 CLEANING

- A. Refer to Section 01 73 00 - Execution.
- B. Remove excess adhesive from floor, base, and wall surfaces without damage to finish.
- C. Recommended cleaning instructions from manufacturer.

END OF SECTION

SECTION 09 68 00  
CARPETING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Carpet, carpet tile, and accessories.

1.2 SUBMITTALS

- A. Product Data: For the following, including installation recommendations for each type of substrate:
  - 1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
- B. Shop Drawings: Show the following:
  - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
  - 2. Carpet type, color, and dye lot.
  - 3. Seam locations, types, and methods.
  - 4. Type of subfloor.
  - 5. Type of installation.
  - 6. Pattern type, repeat size, location, direction, and starting point.
  - 7. Pile direction.
  - 8. Type, color, and location of edge, transition, and other accessory strips.
  - 9. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
  - 1. Carpet: 12-inch- square Sample.
  - 2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- long Samples.
- D. Product Schedule: For carpet, use same designations indicated on Drawings.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.
- G. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
  - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.
- H. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

- B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to carpet installation including, but not limited to, the following:
  - 1. Review delivery, storage, and handling procedures.
  - 2. Review ambient conditions and ventilation procedures.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104, Section 5, "Storage and Handling."

#### 1.5 PROJECT CONDITIONS

- A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
- B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

#### 1.6 WARRANTY

- A. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
  - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
  - 3. Warranty Period: 10 years from date of Substantial Completion.

#### 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

### PART 2 PRODUCTS

#### 2.1 CARPET TILE

- A. Carpet Tile (F3): J&J Flooring Index Style 7008, conforming to the following:
  - 1. Construction: Patterned loop
  - 2. Fiber Type: Encore BCF nylon w/ColorLoc Plus
  - 3. Dye Method: Solution/yarn dyed
  - 4. Ounce Weight: 20 oz/sy (678 grams/m<sup>2</sup>)

5. Gauge: 1/10 (3.94 rows/cm)
  6. Backing: Nexus modular
  7. Size: 24" x 24" (61 cm x 61 cm)
  8. Total Thickness: .025 inches (0.64 cm)
  9. Warranties: Lifetime fiber performance for wear and static; lifetime stain removal; lifetime colorfastness to light and atmospheric contaminants; lifetime for tuft bind strength (edge ravel, yarn pulls, zippering); lifetime against delamination; lifetime dimensional stability
  10. Installation: 1/4 turn
- B. Carpet Tile (F5): J&J Flooring with a twist 7080, conforming to the following:
1. Construction: Textured loop
  2. Fiber Type: Encore SD Ultima nylon with recycled content
  3. Dye Method: Solution dyed
  4. Ounce Weight: 21.0 oz/sy (712 grams/m<sup>2</sup>)
  5. Gauge: 1/10 (3.94 rows/cm)
  6. Backing: Nexus modular
  7. Size: 24" x 24" (61 cm x 61 cm)
  8. Total Thickness: .025 inches (0.64 cm)
  9. Warranties: Lifetime fiber performance for wear and static; lifetime stain removal; lifetime colorfastness to light and atmospheric contaminants; lifetime for tuft bind strength (edge ravel, yarn pulls, zippering); lifetime against delamination; lifetime dimensional stability
  10. Installation: Monolithic
- C. Carpet Tile (F6): J&J Flooring Catwalk II 7268, conforming to the following:
1. Construction: Textured patterned loop
  2. Fiber Type: 100% Encore SD Nylon with recycled content
  3. Dye Method: Solution dyed
  4. Ounce Weight: 34.0 oz/sy (1153 grams/m<sup>2</sup>)
  5. Gauge: 1/10 (3.94 rows/cm)
  6. Backing: Nexus modular
  7. Size: 24" x 24" (61 cm x 61 cm)
  8. Total Thickness: .0375 inches (0.95 cm)
  9. Warranties: Lifetime fiber performance for wear and static; lifetime stain removal; lifetime colorfastness to light and atmospheric contaminants; lifetime for tuft bind strength (edge ravel, yarn pulls, zippering); lifetime against delamination; lifetime dimensional stability
  10. Installation: 1/4 turn
- D. Carpet Tile (M8 – Temporary Phasing Carpet): J&J Flooring Passages 3036, conforming to the following:
1. Construction: Level loop
  2. Nylon Fiber Type: Encore SD Ultima (with recycled content)
  3. Dye Method: Solution dyed
  4. Face Weight: 20 oz/sy (678 grams/m<sup>2</sup>)
  5. Gauge: 1/10 (3.94 rows/cm)
  6. Backing: Premier Bac Plus (standard backing)
  7. Standard Width: 12'

8. Standard Warranties: Encore SD Ultima Fiber, PremierBac Plus, Commercialon Premium Broadloom Adhesive.

## 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.
1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:
- Total VOCs: 10.00 mg/sq. m x h.
  - Formaldehyde: 0.05 mg/sq. m x h.
  - 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.
- C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
- D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
- Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
  - Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
  - Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

### 3.3 INSTALLATION

- A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:
  - 1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
- B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Do not bridge building expansion joints with carpet.
- D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.
- H. Comply with carpet cushion manufacturer's written recommendations.
- I. The manufacturer's representative shall be present upon start of carpet installation to insure proper installation methods.

### 3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing carpet:
  - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
  - 2. Remove yarns that protrude from carpet surface.
  - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION

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SECTION 09 90 00  
PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation and field application of paints and coatings.

1.2 RELATED SECTIONS

- A. Section 05 12 00 - Structural Steel - Field finish.
- B. Section 05 30 00 - ER6.5 Steel Deck
- C. Section 05 31 00 - Steel Decking: Field finish of exposed deck.
- D. Section 05 50 00 - Metal Fabrications: Shop primed items.
- E. Section 06 20 00 - Finish Carpentry - Field Finish.
- F. Section 08 11 00 - Steel Doors and Frames - Field Finish.
- G. Section 08 21 00 - Flush Wood Doors
- H. Section 09 26 00 - Gypsum Board Systems.
- I. Division 23 - Mechanical Identification and Painting of Exposed Ductwork
- J. Division 26 - Electrical: Electrical Identification.

1.3 REFERENCES

- A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM D2016 - Test Method for Moisture Content of Wood.
- C. AWWA (American Water Works Association) - C204 - Chlorinated Rubber-Alkyd Paint Systems for the Exterior of Above Ground Steel Water Piping.
- D. AWWA (American Water Works Association) - D102 - Painting Steel Water Storage Tanks.
- E. NACE (National Association of Corrosion Engineers) - Industrial Maintenance Painting.
- F. NPCA (National Paint and Coatings Association) - Guide to U.S. Government Paint Specifications.
- G. PDCA (Painting and Decorating Contractors of America) - Painting - Architectural Specifications Manual.
- H. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.4 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this Section.

## 1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data on all finishing products.
- C. Samples: Submit two color chip selection catalogs illustrating range of colors available for each surface finishing product scheduled.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures, substrate conditions requiring special attention.
- E. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

## 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten (10) years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum five (5) years documented experience and approved by manufacturer.

## 1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame and smoke rating requirements for finishes.

## 1.8 FIELD SAMPLES

- A. Provide field sample of paint under provisions of Section 01 40 00.
- B. Provide field sample classroom, illustrating special coating color, texture, and finish.
- C. Locate where directed.
- D. Accepted sample may remain as part of the Work.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- D. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

## 1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperature for Varnish and Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## 1.12 EXTRA MATERIALS

- A. Furnish under provisions of Section 01 73 00.
- B. Provide 1 gallon of each color, and type to Owner.
- C. Label each container with color, type, texture, room locations, and in addition to the manufacturer's label.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers - Paint
  - 1. PPG.
  - 2. Sherwin-Williams.
  - 3. Benjamin Moore.
- B. Manufacturers - Transparent Finishes
  - 1. Min-Wax.
  - 2. PPG Model REZ.
  - 3. Valspar
- C. Manufacturers - Stain
  - 1. Min-Wax.
  - 2. PPG Model REZ.
  - 3. Valspar.
- D. Manufacturers - Primer Sealers
  - 1. PPG - 6 Line.
  - 2. Benjamin Moore.
  - 3. Sherwin-Williams.
  - 4. Duron
- E. Substitutions: Under provisions of Section 01 60 00.

### 2.2 MATERIALS

- A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- C. Patching Materials: Latex filler.

- D. Fastener Head Cover Materials: Latex filler.

## 2.3 FINISHES

- A. Refer to schedule at end of section for surface finish schedule. Colors will be selected during construction.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 31 00.
- B. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Plaster and Gypsum Wallboard: 12 percent.
  - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
  - 3. Interior Wood: 15 percent, measured in accordance with ASTM D2016.

### 3.2 PREPARATION

- A. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.
- C. Seal with shellac and seal marks which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- F. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- H. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- I. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

- J. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool, wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- K. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
- L. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- M. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- N. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

### 3.3 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish.
- D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- E. Sand wood and metal lightly between coats to achieve required finish.
- F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
- G. Allow applied coat to dry before next coat is applied.
- H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- I. Prime concealed surfaces of interior woodwork with primer paint.
- J. Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

### 3.4 CLEANING

- A. Clean work under provisions of 01 73 00.
- B. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

### 3.5 INTERIOR PAINT SYSTEMS

- A. NEW MASONRY:
  - 1. Acrylic Latex System (Dry Areas)
    - a. 1st Coat: S-W PrepRite® Block Filler, B25W25 (75-125 sq ft/gal)
    - b. 2nd & 3rd Coats: Semi-gloss – S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600.
  - 2. High Performance Catalyzed Epoxy System (High Moisture Areas)
    - a. 1st Coat: S-W KEM CATI-COAT HS Epoxy Filler/Sealer B42W400 Series.

- b. 2nd & 3rd Coats: Gloss: S-W Pro Industrial HP Epoxy, B67-200 Series.
- B. GYPSUM BOARD & PLASTER:
  - 1. 1<sup>st</sup> Coat: Latex Primer: S-W ProMar 200 Zero VOC Latex Primer, B28W2600.
  - 2. 2<sup>nd</sup> & 3<sup>rd</sup> Coats: Eggshell Latex: S-W ProMar 200 Zero VOC Latex Egg-Shell, B20-2600.  
Apply 1<sup>st</sup> coat only on walls receiving vinyl wall covering.
- C. FERROUS METALS:
  - 1. 1st Coat: Primer S-W Pro Industrial Pro-Cryl Primer, B66-310 Series.
  - 2. 2nd & 3rd Coat: Semi-Gloss: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45 Series.
- D. WOOD DOORS AND TRIM (New)
  - 1. 1st Coat: Oil/Wiping Stain: Match existing wood with clear wood sealer.
  - 2. 2nd and 3rd Coats: Polyurethane Satin: S-W Wood Classics® Watreborne Polyurethane Varnish, Satin.
- E. WOOD PAINTED
  - 1. 1st Coat (Primer): S-W Premium Wall & Wood Primer, B28W8111.
  - 2. 2nd & 3rd Coats: Semi-Gloss: S-W ProMar 200 Waterbased Acrylic/.Alkyd Semi-Gloss, B34-8200.
- F. METAL DOORS, TRIM & EXPOSED STRUCTURAL STEEL
  - 1. Touch-up existing primer. S-W Pro Industrial Pro-Cryl Primer, B66-310 Series.
  - 2. 2nd & 3rd Coats: Semi-Gloss: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45.

### 3.6 EXTERIOR PAINT SYSTEMS

- A. Ferrous metals (normal use and atmosphere).
  - 1. Location: All structural and miscellaneous steel, hollow metal doors and frames and fire hydrants.
  - 2. System: Oil Alkyd (gloss).
    - a. First Coat: Touch-up Primer: S-W Pro Industrial Pro-Cryl Primer, B66-310 Series.
    - b. Second and Third Coat: S-W Pro Industrial Urethane Alkyd Enamel, B54-100 Series.
- B. Fiber Cement Siding & Trim (Acrylic Latex System)
  - 1. 1<sup>st</sup> Coat (primer): S-W Loxon Concrete Masonry Primer Sealer, A24W8300.
  - 2. 2<sup>nd</sup> Coat: Exterior Flat: S-W A-100 Exterior Latex Flat, A6 Series.

### 3.7 SCHEDULE

- A. Existing steel tube trusses and purlins
  - 1. Touch up exposed areas damaged during construction.
- B. New steel tubes trusses and purlins
  - 1. Shop primed and field painted per Article 3.5. Color to match existing Blue.

END OF SECTION

SECTION 09 96 60  
CLEAR, WRITE-AND-ERASE FINISH

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General Conditions, Division 1, and other applicable specification sections in the Project Manual apply to the work specified in this Section.

1.2 SUMMARY

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing and application for clear, write-and-erase finishes as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
- B. Section Includes: The work specified in this Section includes, but shall not be limited to, a waterbased finish for interior walls that is specially formulated to work as a write-and-erase surface.

1.3 REFERENCES

- A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
  - 1. *Gypsum Association (GA)*: GA 214, "Recommended Specification: Levels of Gypsum Board Finish."
  - 2. *American Society for Testing and Materials (ASTM)*: ASTM D 2486, "Standard Test Method for Scrub Resistance of Interior Latex Flat Wall Paints." ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."
  - 3. *South Coast Air Quality Management District (SCAQMD)*: SCAQMD Rule #1168, "Adhesive and Sealant Applications," including most recent amendments.

1.4 SUBMITTALS

- A. General: See Section 01 33 00 - Submittal Procedures
  - 1. Maintenance Data: Submit maintenance data for clear, dry erase finishes to include in operation and maintenance manuals specified in Division 1.
- B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications.
- C. Quality Control Submittals
  - 1. Qualification Data: Submit qualification data for firms and persons specified in Quality Assurance Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of architects and owners, and other information specified.
  - 2. Test Reports: Submit product test reports from a qualified independent inspecting and testing agency showing compliance of clear write/erase finishes with requirements, based on comprehensive testing of current product formulations within the last two years.

## 1.5 QUALITY ASSURANCE

### A. Qualifications

1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of clear finishes of type required, and whose products have been in satisfactory use in similar service for a minimum of five years.
2. Applicator Qualifications: Applicator shall be a firm that shall have a minimum of five years of successful application experience with projects utilizing clear finishes similar in type and scope to that required for this Project.
3. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.
4. Mock Ups: Prior to application of the work, fabricate and erect mock ups for each type of finish and application required to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock ups to comply with the following requirements, using materials indicated for final unit of work. Locate mock ups on site in location and of size indicated or, if not indicated, as directed by the Architect. Demonstrate the proposed range of aesthetic effects and workmanship to be expected in the completed work. Obtain the Architect's acceptance of mock ups before start of final unit of work. Retain and maintain mock ups during construction in undisturbed condition as a standard for judging completed unit of work.
  - a. Accepted mock ups in undisturbed condition at time of Substantial Completion may become part of completed unit of work.
5. Pre-Application Conference: Conduct pre-application conference in accordance with Section 01039. Prior to commencing the application, meet at the Project site to review the material selections, application procedures, and coordination with other trades. Mock ups shall be reviewed during the pre-application conference. Pre-application conference shall include, but shall not be limited to, the Contractor, the Applicator, manufacturer's representatives, and any trade that requires coordination with the work. Date and time of the pre-application conference shall be acceptable to the Owner and the Architect.

## 1.6 DELIVERY AND STORAGE

- A. Delivery: Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.
- B. Storage: Store materials in their original, undamaged packages and containers, inside a well ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

## 1.7 PROJECT CONDITIONS

- A. Environmental Requirements: Do not apply Wink finish until space is enclosed and weatherproof, wet work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### A. Technical Information and Test Results

1. Suitable Substrates: Gypsum board, smooth sealed wood, previously painted surfaces, and others in accordance with the manufacturer's recommendations



2. Colors Available: Finish is clear
3. Coverage Rate: Kits will provide coverage of approximately 50, 100, or 200 square feet of surface area
4. Finish: Gloss 92 at a 60 degree
5. Maximum VOC: Less than 50 grams per liter, EPA Test Method 27
6. Fire Rating: Class A or Class I, ASTM E 84
7. Scrub Resistance: 10,000+ scrub cycles, ASTM D 2486
8. Stain Removal: Excellent rating.
9. Basis of Design: Product specified is “Wink” as manufactured by Master Coating Technologies. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other manufacturers are acceptable. The Architect will be the sole judge of the basis of what is equivalent.
10. Accessories: Provide accessories as recommended by the manufacturer, including, but not limited to, the following:
  - a. Markers: Expo Low Odor or Bold Dry Erase Markers.
  - b. Cleaner/Wipes: Expo Dry Erase Board Cleaner and/or Cleaning Wipes.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which the work is to be applied, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Applicator.

#### 3.2 PREPARATION

- A. Product Preparation: Gloves, goggles, and a respirator shall be worn when pouring and mixing. Thinning is not required for brush or roller application.
- B. Surface Preparation: Prepare surfaces to Level 5 smoothness in accordance with GA 214. Primer/sealers and base coats may be brushed, rolled, or sprayed. Sprayed application is preferred in order to provide the smoothest surface for the application of the Wink write-and-erase finish.
- C. Gypsum Board: Prepare to Level 5 finish for best results. Provide two base coats of manufacturer’s recommended product. Ensure uniform color across surface.
- D. Primed Metal: Provide two base coats of manufacturer’s recommended product.
- E. Unprimed Metal: Provide manufacturer’s recommended primer and two base coats of product.
- F. Previously Painted Surfaces: Provide two base coats of manufacturer’s recommended product.

#### 3.3 APPLICATION

- A. Required Materials: Nine inch, lint-free 1/4" nap roller cover; paint roller; metal painter’s tray; low-tack painter’s tape; Wink Part A, Part B, and a stir stick.

- B. Preparation
1. Over Existing Painted Surfaces: The surface should be clean, dry, and free of grease and mildew. Since Wink is a high-gloss, clear coating, it will highlight any imperfections, so take the necessary steps to ensure a smooth surface prior to application.
  2. If Repainting Before Applying Wink: Sand the existing wall to remove any high points or imperfections and fill any holes or scratches. Apply primer and paint so the wall is as smooth as possible with very little stipple and no lap marks or roller lines. Allow to fully dry (4+ hours depending on conditions) before applying Wink.

*IMPORTANT: Mask surrounding areas with low-tack painter's tape. Wink dries quickly, so remove tape while finish is still wet. Any material found under the painter's tape can be removed with a damp rag.*

- C. Mixing: Stir mixture while pouring Part B into Part A. Mix thoroughly for 3 to 3-1/2 minutes. As Parts A and B are incorporated, Wink will begin to thicken slightly. Be sure to incorporate any unmixed paint on the inner sides of the can into the middle. Allow mixed Wink to "sweat-in" for 5 minutes.

*IMPORTANT: Once Parts A and B are mixed, Wink must be used within 1 hour. Do not combine multiple kits. Do not reseal cans once opened; contents will expand.*

- D. Application: Pour Wink into a clean metal tray and apply with a lint-free 1/4" nap roller. Cut in only as far as you are able to paint before the mixture begins to dry. Roll vertically, maintaining a wet edge. Lay off in one direction, from top to bottom. Work in manageable 3–4 ft. sections. Inspect the application from multiple angles to ensure uniform coverage and no pinholes.

- E. Curing: Surface will be writable in 4 days.

### 3.4 CLEANING AND MAINTENANCE

- A. Clean Up: Dispose of roller. Clean equipment immediately after application with warm soapy water and disposable rag. Do not flush waste material into any drain.
- B. Disposal: Product contains no chromium, lead, or mercury. Disposal of containers shall be in accordance with applicable federal, state and local laws and regulations. Comply with requirements of authorities having jurisdiction concerning reuse, recycling, or disposal or unused product.
- C. Maintenance: For daily erasing and cleaning, we recommend using a microfiber cloth. A dry-erase cotton cloth can also be used; however, we do not recommend Expo<sup>®</sup> or other brand felt erasers. Periodically use a clean, damp cloth with mild soap or just water—or disposable wipes—to maintain the surface. Expo Dry Erase Board Surface Cleaner or Cleaning Wipes also work well. After using a cleaner, it's best to wipe the surface with clean water to remove any residue. Regular household cleaners (such as Win-dex<sup>®</sup> or Formula 409<sup>®</sup>) should not be used, as they can damage the Wink surface.

### 3.5 PROTECTION

- A. General: Protect and maintain conditions in a manner acceptable to the Applicator, ensuring that the write-and-erase surface is without damage at time of Substantial Completion.

END OF SECTION

SECTION 10 12 00  
INFORMATION DISPLAY SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 specification sections apply to this section.

1.02 SUMMARY

- A. This section includes the following component type information display systems:
  - 1. Freestanding Information Display System.
  - 2. Suspended Information Display System.

1.03 PERFORMANCE REQUIREMENTS

- A. Structural performance: Design, engineer, and fabricate display systems so that when installed, they are capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials, including anchors and connections and without exhibiting permanent deformation in any of the components making up enclosures:
  - 1. 200 lb. concentrated load at centerline of monitor or sign cabinet.
- B. Corrosion control: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 SUBMITTALS

- A. Product Data:
  - 1. Shop drawing showing fabrication and installation of Information Display Systems, including plans, elevations, sections, details of components, and attachments to other units of work.
  - 2. Manufacturer's recommended maintenance instructions.
  - 3. For illuminated display units, include wiring diagrams and rough-in details.
- B. Manufacturer Information:
  - 1. Provide overview of literature describing manufacturer's overall scope of products and manufacturing capabilities.
  - 2. Provide URL for manufacturer's website; website must provide access to technical data, images and general product information.
- C. Samples for verification of each type of exposed finish required, prepared on components indicated below of same thickness and metal indicated for final unit of work. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected:
  - 1. 6-inch long sections of extruded aluminum mast.
  - 2. Cast stainless steel support arm.
  - 3. 2-foot long section of support beam assembly.

1.05 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain display systems of each type and material from a single manufacturer.

- B. Fabricator Qualifications:
  - 1. Fabricator shall have minimum of ten years successful in fabrication of work of this section, similar to items required for this project, shall be approved by the architect prior to the start of production.
  - 2. Fabricator must have sufficient production capacity to produce, transport and deliver required units without causing delay in the work.
  - 3. Fabricator shall have experience of at least five previous successfully completed projects of equal or greater complexity as this project and shall submit photographs for review and acceptances.
- C. Welding Standards:
  - 1. Comply with applicable provisions of AWS D1.1 “Structural Welding Code-Steel” and AWS D1.3 “Structural Welding Code-Sheet Steel.”
  - 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

## 1.06 DELIVERY, STORAGE AND HANDLING

- A. Handle products in accordance with manufacturer’s instructions.
- B. Store products in manufacturer’s original packaging until ready for installation.
- C. Protect products from impacts and abrasion during storage.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, include but are not limited to the following:

Forms+Surfaces  
30 Pine Street  
Pittsburgh, PA 15223  
phone: 800-451-0410  
fax: 412-781-7840  
email: [sales@forms-surfaces.com](mailto:sales@forms-surfaces.com)  
website: [www.forms-surfaces.com](http://www.forms-surfaces.com)

- B. Design of Information Display System units is based on the “InForm Flight Information Displays” by Forms+Surfaces. Other manufacturers offering products of similar configuration, quality and performance shall be pre-approved by the architect.

### 2.02 METALS

- A. General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.
- B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy and temper designated below for each aluminum form required:
  - 1. Extruded Bar and Tube: ASTM B 221, alloy 6063-T5/T52.
  - 2. Drawn Seamless Tube: ASTM B 210, alloy 6063-T832.
  - 3. Plate and Sheet: ASTM B 209, alloy 6061-T6.
  - 4. Die and Hand Forgings: ASTM B 247, alloy 6061-T6.

5. Castings: ASTM B 26, alloy A356-T6.
  6. Refer to Drawings for aluminum shapes, types and finish designations.
- C. Stainless Steel: Grade or type designated below for each form required:
1. Tubing: ASTM A 554, Grade MT 304
  2. Pipe: ASTM A 312, Grade TP 304
  3. Castings: ASTM A 743, Grade CF 8 of CF 20
  4. Plate: ASTM A 666, Type 304
  5. Refer to Drawings for stainless steel shapes, types and finish designations

## 2.03 MISCELLANEOUS MATERIALS

- A. Filler metal and electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as required for color match, strength, corrosion resistance, and compatibility in fabricated items.
- B. Bituminous paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

## 2.04 FASTENERS

- A. Fasteners for anchoring Information Display System to other construction: Select fasteners of the type, grade and class required to produce connections that are suitable for anchoring display system to other types of construction indicated and capable of withstanding design loadings.
1. Provide fasteners fabricated from alloy type 304 for interior and type 316 stainless steel at exterior. Provide #7 polished finish.
- B. Fasteners for Information Display System: Use fasteners of same basic metal as the fastened metal, unless indicated. Do not use metals that are corrosive or incompatible with materials joined.
1. Provide concealed fasteners for interconnecting display cabinets and for attaching them to other work, except where otherwise indicated.
  2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

## 2.05 FABRICATION

- A. General: Fabricate information displays to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than that required to support structural loads.
- B. Assemble information displays in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Stainless steel/aluminum Information Display Systems using the following parts and components:
1. Freestanding or suspended units.
  2. InForm cast stainless foot assembly – Part No. P1.B002.
  3. InForm cast stainless 125mm support arm – Part No. P1.W009.
  4. InForm cast stainless mast end cap – Part No. P1.W007.
  5. InForm extruded aluminum mast profile – Part No. P1.E015.
  6. InForm extruded aluminum Conceal extrusion – Part No. P1.FS002 (or) extruded aluminum Arc extrusion – Part No. P1.FS001.
  7. Adjustable brackets for monitor support.
  8. Miscellaneous components necessary for a complete installation.

- D. Form simple and compound curves by bending members in fixtures to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of finished material.
- E. Welded connections: Fabricate stainless bumper rails by welding. For connections made during fabrication, weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortions and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- F. Nonwelded connections: Fabricate Information Display System by connecting members with manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- G. Brackets, flanges fittings, and anchors: Provide manufacturer's standard brackets, flanges, miscellaneous fittings, and anchors to connect mast profiles to support beam and foot connections.
- H. Provide inserts and other anchorage devices to connect Information Display System to concrete or masonry work. Coordinate anchorage devices with supporting structure on site.
- I. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.
- J. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.
- K. Cut, reinforce, drill and tap components, as indicated, to receive finish hardware, screws, and similar items.
- L. Provide power and data management system through mast grommets and components from floor supply points to each electronic component or assembly. Include flexible black rubber connectors as required to conceal all wiring.

## 2.06 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" recommendations relative to applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering prior to shipment.
- C. Appearance of finished work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and they are assembled or installed to minimize contrast.
- D. Stainless steel finishes:
  - 1. Remove or blend tool and die marks and stretch lines into finish.
  - 2. Grind and polish surfaces to produce uniform directional, textured or polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

3. Brushed, directional polish: as specified herein above.
  4. Seastone stainless steel finish as supplied by Forms+Surfaces.
- E. Aluminum finishes:
1. Remove or blend tool and die marks into finish.
  2. Grind and polish surfaces to produce uniform directional, textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
  3. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish; non-specular as fabricated; chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.7 mil (0.018 mm) or thicker) complying with AAMA 607.1.

### PART 3 EXECUTION

#### 3.01 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to project site.

#### 3.02 INSTALLATION, GENERAL

- A. Fit exposed connections accurately together to form tight, hairline joints.
- B. Cutting, Fitting and Placement: Perform cutting, drilling, and fitting required for installing Information Display units. Set assemblies accurately in location, alignment, and elevation measured from established lines and levels and free from rack:
1. Do not weld, cut, or abrade surfaces of Information Display System components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.
  2. Set posts plumb within a tolerance of 1/4-inch in 12 feet; 1/8-inch in 6 feet.

#### 3.03 ANCHORING POSTS

- A. Anchor Information Display Systems in concrete with bolts anchored into concrete. Select type of fastener that provides the required performance.

#### 3.04 ADJUSTING AND CLEANING

- A. Clean stainless steel, glass aluminum in accordance with manufacturers written Instructions.

#### 3.05 PROTECTION

- A. Protect finishes of displays from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of substantial completion.
- B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION

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SECTION 10 21 15  
SOLID COLOR REINFORCED COMPOSITE TOILET PARTITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Solid Color Reinforced Composite Toilet Compartments, ceiling hung.

1.2 RELATED SECTIONS

- A. Section 05 50 00 – Metal Fabrications: Above ceiling structural support.
- B. Section 09 11 10 - Metal Stud Framing System: In wall framing and plates for partition panel support.
- C. Section 10 80 00 - Toilet and Bath Accessories.

1.3 REFERENCES

- A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. ANSI/ASTM A424 - Steel Sheets for Porcelain Enameling.
- C. ANSI/ASTM A526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- D. ASTM A167 - Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- E. FS RR-P-1352 - Partitions, Toilet, Complete.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Indicate on shop drawings, partition plan and elevation views, dimensions, details of wall, floor supports, and door swings.
- C. Provide product data on panel construction, hardware, and accessories.
- D. Submit samples under provisions of Section 01 33 00.
- E. Submit two samples 6 x 6 inches in size illustrating panel finish, color, and sheen.
- F. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.6 WARRANTY

- A. In accordance with Section 01 77 00, submit a manufacturer's 10 year warranty for all products against breakage, corrosion, delamination and defects.
- B. Furnish 1 year warranty against defects in material & workmanship for stainless steel hardware & brackets.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Toilet Partitions: Bobrick – Sierra Series (1098) ceiling hung.
- B. Substitutions: Under provisions of the General Conditions to the Construction Contract.

### 2.2 COMPONENTS

- A. Toilet Compartments: Solid Color Reinforced Composite panels, doors, and pilasters, ceiling hung.
  - 1. Color: Single color as selected by architect.
- B. Toilet Partition Materials
  - 1. Toilet partitions shall be constructed of Solid Color Reinforced Composite material, which is composed of dyes, organic fibrous material, and polycarbonate/ phenolic resins. Material shall have a non-ghosting, graffiti-resistant surface integrally bonded to core through a series of manufacturing steps requiring thermal and mechanical pressure. Edges of material shall be the same color as the surface.
- C. Stiles, Panels, Doors, and Screens shall be all manufactured from Solid Color Reinforced Composite material.
- D. Door and Panel Dimensions:
  - 1. Door Thickness: 3/4 inch Panel. Panel thickness 1/2 inch
  - 2. Door Width: 24 inch.
  - 3. Accessible Door Width: 36 inch, out-swinging.
  - 4. Height: 58 inch.
  - 5. Thickness of Pilasters: 3/4 inch.

### 2.3 ACCESSORIES

- A. Head Rails: Extended extruded anodized aluminum satin finish.
- B. Brackets: Satin anodized aluminum, to clear color.
- C. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
  - 1. Used for attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
- D. Hardware: 1098G.67 Full Height Gap Free Institutional
  - 1. Heavy-gauge, type 304 satin finished stainless steel.
  - 2. Hinge adjusts for partial opening or self-closing door.
  - 3. Through-bolting panel-to-stile brackets.
  - 4. Reinforced latch with through-bolting keeper.
  - 5. Vandal-resistant door stops.
  - 6. Through-bolting robe hook, one per compartment, mounted on door.

### 2.4 PERFORMANCE REQUIREMENTS

- A. Graffiti Resistance: Partition material shall have the following graffiti removal characteristics when tested in accordance with ASTM D6578-00 Standard Practice for Determination of Graffiti Resistance in accordance with Section 9, "Graffiti Removal Procedure Using Manual Solvent Rubs":
  - 1. Cleanability: Five (5) required staining agents shall be cleaned off material.

- B. Scratch Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D 2197-98 (2002) Standard Test Method for Adhesion of Organic Coating by Scrape Adhesion, using Gardner Stock # PA-2197/ST pointed stylus attachment on scrape tester:
  - 1. Scratch Resistance: Maximum Load Value shall exceed 10 kilograms.
- C. Impact Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM d2794-93 (1999) el Standard Test Method for Resistance of Organic Coating to the Effects of Rapid Deformation (Impact), using .625" hemispherical indenter with 2-lb impact weight:
  - 1. Impact Resistance: Maximum Impact Force value shall exceed 30 inch-lbs.
- D. Fire Resistance: Partition material shall comply with the following requirements, when tested in accordance with ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials:
  - 1. Smoke Developed Index: Not to exceed 450.
  - 2. Flame Spread Index: Not to exceed 75.
  - 3. Material Fire Ratings:
    - a. National Fire Protection Association (NFPA): Class B.
    - b. International Code Council (ICC): Class B.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify correct spacing of plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing, where required.
- D. Beginning of installation means acceptance of substrate.

### 3.2 INSTALLATION

- A. Install partitions secure, plumb, and level and in accordance with manufacturers' instructions.
- B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to bracket with through sleeve tamperproof bolts and nuts. Locate head rail joints at pilaster center lines.
- E. Equip each door with continuous hinges, one door latch, and one coat hook and bumper.
- F. Install door strike and keeper with door bumper on each pilaster in alignment with door latch.
- G. Adjust hinges to locate doors in partial open position when unlatched. Return outswing doors to close position.

### 3.3 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

### 3.4 CLEANING

- A. Remove protective masking. Clean surfaces.
- B. Field touch-up of scratches or damaged finish will not be permitted.
- C. Replace damaged or scratched materials and with new materials.

END OF SECTION

SECTION 10 26 00  
WALL PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Flexible wall protection.
- B. Rigid sheet vinyl.
- C. Corner guards.

1.2 RELATED SECTIONS

- A. Section 06 11 40 - Wood Blocking and Curbing: Support blocking for wall and corner guard anchors.
- B. Section 09 26 00 - Gypsum Board System: Wall construction.

1.3 REFERENCES

- A. Section 01 40 00 – Quality Requirements: Requirements for references and standards.
- B. Americans with Disabilities Act (ADA) - Accessibility Guidelines for Buildings and Facilities.
- C. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People.

1.4 PERFORMANCE REQUIREMENTS

- A. Installed Wall Rail Component Assembly:
  - 1. Support vertical live load of 100 lb/lineal ft. with deflection not to exceed 1/50 of span between supports.
  - 2. Resist lateral impact force of 75 lbs at any point without damage or permanent set.
- B. Corner Guards: Resist lateral impact force of 100 lbs at any point without damage or permanent set.

1.5 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittal Procedures: Procedures for submittals.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, rough-in measurements, and end details.
- C. Samples: Submit two (2) sections of rub rail and corner guard, 24 inch long, illustrating component design, configuration, color and finish.

1.6 SUBMITTALS FOR INFORMATION

- A. Section 01 33 00 – Submittal Procedures: Procedures for submittals.
- B. Manufacturer's Instructions: Printed installation instructions for specified products; indicate special procedures, and perimeter conditions requiring special attention.

1.7 REGULATORY REQUIREMENTS  
WALL PROTECTION

- A. Conform to ADA and ANSI A117.1 requirements for the physically handicapped.

## 1.8 PROJECT CONDITIONS

- A. Coordinate the work with wall or partition sections for installation of concealed blocking or anchor devices.

## 1.9 WARRANTY

- A. Provide manufacturer's standard five (5) year warranty against defects.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. In Pro Corp. (IPC): Institutional Products Corp. of Muskego, Wisconsin
- B. Substitutions: In accordance with Section 01 60 00 – Product Requirements.

### 2.2 COMPONENTS

- A. Flexible Wall Protection (W4, W5): Equal to Inpro Corp. Ricochet Flexible Wall Protection, conforming with the following:
  - 1. Wall coverings: Ricochet™ Flexible Wall Protection
    - a. Finished width: 48 inches.
    - b. Inks: HAPS free, Ethyl Acetate.
    - c. Low VOC emitting:
      - 1) Meets California 01350 Specification for low VOC emissions.
    - d. Packaging – 15 yard rolls
  - 2. Physical Properties:
    - a. Finished total weight: Fed. Spec. CCC-T-191b 5041.
      - 1) Thickness: .032" - .040" (varies by emboss and finish)
      - 2) 34 to 38 oz. per linear yard (555g to 620 g/linear m). [varies by emboss and finish]
    - b. PVF protective cap film.
    - c. Backing Type: Poly/Cotton knit. (77%/23%)
  - 3. Surface Properties
    - a. Impact Resistance – ASTM D-5420 – Gardener Drop Dart – 44 to 112+ inch-lbs
    - b. Abrasion Resistance ASTM D-4060 Taber CS-10f wheel 500 gram load – 200 cycles, 0.02% weight loss.
    - c. Chemical Resistance – ASTM D-1308 – 10 cleaning agents, 10 staining agents, after 7 days, no change
    - d. Stain Resistance – ASTM D-1308 - 10 cleaning agents, 10 staining agents, after 7 days, no change
  - 4. Fire Ratings
    - a. Surface burning characteristics, ASTM E 84: Class A.
      - 1) Flame Spread Index: 10
      - 2) Smoke Developed Index: 120.
  - 5. Environment and Health
    - a. CAL 01350 – Certified
    - b. Fungal Resistance – ASTM G-21 – No growth
    - c. Bacterial Resistance – ASTM G-22 – No growth
    - d. EPD - 3rd Party Certified
    - e. HPD – 3rd Part Certified
    - f. NSF/ANSI 342 Certified to Wallcovering Association Sustainability Standard

6. Design:
  - a. Pattern: Select from Ricochet™ pattern selection.
    - 1) Color: Select from Ricochet™ color palette.
- B. Rigid Sheet Vinyl (W3): Equal to Inpro Corp. Rigid Sheet Vinyl, conforming with the following:
  1. Palladium® Rigid Vinyl Sheet
    - a. Item No. 306, 3'x 8', .060" = 1/16"
    - b. Vinyl: Palladium® Rigid Vinyl Sheet Elements Style shall be manufactured from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added (plasticizers may aid in bacterial growth).
  2. Top caps shall be made of extruded PVC.
  3. Finishes:
    - a. Color or pattern of Palladium® Rigid Vinyl Sheet to be selected by the architect from the IPC Sheet finish selection. Surface shall have a velvet texture.
    - b. Vinyl Accessories: Top caps, inside corners, divider bars and outside corners shall be of a color matching the IPC.
    - c. Color or pattern of Palladium Wall Boards to be selected by the architect from the IPC finish selection. Surface shall have a velvet texture.
- C. Corner Guards: Equal to Inpro Corp. 160BN BluNose High Impact Corner Guard, conforming with the following:
  1. 160BN BluNose High Impact Corner Guard Profile
    - a. 2" (51 mm) x 2" (51 mm), 90 degrees
    - b. 8' (2.44 m) standard height
    - c. Custom Angles – Provide vinyl covers and retainers with custom angles. Custom angles shall be between 112.5° and 157.5°. Provide flexible top caps to bend to retainer angle.
  2. Vinyl Covers:
    - a. Snap on cover of .080" (2 mm) thickness shall be extruded from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added (plasticizers may aid in bacterial growth).
    - b. Vinyl Retainers: Continuous vinyl retainers of .070" (1.8 mm) thickness with a Biopolymer Flex PVC apex shall be fabricated from polyvinyl chloride with the addition of impact modifiers.
  3. Top caps and bottom caps shall be made of injection molded thermoplastics.
    - a. Fasteners: All mounting system accessories appropriate for substrates indicated on the drawings shall be provided.
    - b. Optional flexible top caps shall be made of injection molded Biopolymer Flex PVC.
  4. Vinyl Covers: Colors of the corner guard to be selected by the architect from the IPC finish selection. Surface shall have a pebblette texture.
  5. Molded Components: Top caps and bottom caps shall be of a color matching the corner guards. Surface shall have a pebblette texture.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 40 00 – Quality Requirements: Verification of existing conditions before starting work.
- B. Verify that field measurements are as indicated on Drawings.
- C. Verify that rough-in for components are correctly sized and located.

### 3.2 INSTALLATION

- A. Section 01 40 00 – Quality Requirements: Manufacturer’s instructions.
- B. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.
- C. Position base of corner guard 4 inches above finished floor.
- D. Install corner guard in single piece length for each location; except as otherwise indicated, end-to-end butt joints are not permitted.

### 3.3 ERECTION TOLERANCES

- A. Section 01 40 00 – Quality Requirements: Tolerances.

END OF SECTION



SECTION 10 44 00  
FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire extinguishers
- B. Cabinets
- C. Accessories.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 04 20 00 - Unit Masonry: Placement of rough-in frame for cabinets.

1.3 RELATED SECTIONS

- A. Section 06 11 40 - Wood Blocking and Curbing: Wood blocking and shims.

1.4 REFERENCES

- A. ANSI/NFPA 10 - Portable Fire Extinguishers.
- B. ANSI/UL 92 - Fire Extinguisher and Booster Hose.
- C. ANSI/UL 711 - Rating and Fire Testing of Fire Extinguishers.
- D. UL 8 - Foam Fire Extinguishers.
- E. UL 154 - Carbon Dioxide Fire Extinguishers.
- F. UL 299 - Dry Chemical Fire Extinguishers.
- G. UL 626 - 2 2 Gallon Stored Pressure, Water Type Fire Extinguishers.
- H. UL 1093 - Halogenated Agent Fire Extinguishers.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements, location, and mounting heights.
- C. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01 78 20.

- B. Maintenance Data: Include test, refill or recharge schedules and recertification requirements.

## 1.7 QUALITY ASSURANCE

- A. Provide units conforming with ANSI/UL 711.

## 1.8 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 10 for requirements for extinguishers.

## 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

# PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Larsen's Product.
- B. Modern Metal Products.
- C. J.L. Industries.
- D. Substitutions: Under provisions of Section 01 60 00.

## 2.2 EXTINGUISHERS

- A. MP10 Dry Chemical Type: UL 299, Cast steel tank, with pressure gage; Class 4A-60B:C.

## 2.3 CABINETS

- A. Metal: Formed stainless steel; 18 gage thick base metal.
- B. Configuration:
  - 1. For MP10 Extinguisher: Equal to Larsen's SS 2409-R2 Vertical Duo Clear Acrylic Door with Larsen Loc semi-recessed type, exterior nominal dimensions of 13 inches wide x 27 1/2 inches high and rough opening depth of 6 1/4 inches.
- C. Trim Type: Semi-recessed, returned to wall surface. Recess in wall must not exceed 6 1/4 inches.
- D. Door: 18 gage stainless steel, clear bubble break glass.
- E. Door Glazing: Plastic, clear, 1/8 inch thick acrylic.
- F. Cabinet Mounting Hardware: Manufacturer's standard bracket.
- G. Provide rated cabinets where located in fire rated partitions.

## 2.4 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chromed finish.

## 2.5 FABRICATION

- A. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.
- B. Pre-drill for anchors.
- C. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon roller type catch.
- D. Weld, fill, and grind components smooth.
- E. Glaze doors with resilient channel gasket glazing.

## 2.6 FINISHES

- A. Extinguisher: Steel, enamel to red color.
- B. Cabinet Exterior Trim and Door: Stainless Steel No. 4 finish.
- C. Cabinet Interior: white enamel.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify wall openings under provisions of Section 01 31 00.
- B. Verify rough openings for cabinet are correctly sized and located.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 48 inches from finished floor to inside top of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets on wall brackets.

END OF SECTION

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SECTION 10 80 00  
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Toilet and washroom accessories.
- B. Grab bars.
- C. Washbar.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 04 20 00 - Unit Masonry: Placement of concealed anchor devices.

1.3 RELATED SECTIONS

- A. Section 09 80 00 – Tiling: Wall finishes.
- B. Section 10 21 15 - Solid Color Reinforced Composite Toilet Partitions.

1.4 REFERENCES

- A. ANSI A117.1 - Safety Standards for the Handicapped.
- B. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- E. ASTM A366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- F. ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- G. NEMA LD-3 - High Pressure Decorative Laminates.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

1.6 REGULATORY REQUIREMENTS

- A. Conform to ANSI A117.1 code for access for the handicapped.

## 1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on product data and instructed by the manufacturer.

## 1.9 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.
- B. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Bobrick, Product as specified.
- B. Bradley, Products as specified.
- C. Other acceptable manufacturers offering equivalent products.
  - 1. A & J Washroom Accessories.
  - 2. Parker.
- D. Substitutions: Under provisions of Section 01 60 00.

### 2.2 MATERIALS

- A. Sheet Steel: ASTM A366.
- B. Stainless Steel Sheet: ASTM A167, Type 304.
- C. Tubing: ASTM A269, stainless steel.
- D. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, and security type.
- E. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

### 2.3 FABRICATION

- A. Weld and grind joints of fabricated components, smooth.
- B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.
- C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. Form bar with 1 1/2 inches clear of wall surface. Knurl grip surfaces.
- D. Shop assemble components and package complete with anchors and fittings.
- E. Provide steel anchor plates, adapters, and anchor components for installation.

### 2.4 KEYING

- A. Supply six (6) keys for each accessory to Owner.

- B. Master key all accessories.

## 2.5 FINISHES

- A. Galvanizing: ASTM A123 to 1.25 oz/sq yd. Galvanize ferrous metal and fastening devices.
- B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- C. Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats electrostatic baked enamel.
- D. Chrome/Nickel Plating: ASTM B456, Type SC 2 satin finish.
- E. Stainless Steel: No. 4 satin luster finish.
- F. Back paint components where contact is made with building finishes to prevent electrolysis.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 31 00.
- B. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings and instructed by the manufacturer.
- C. Verify exact location of accessories for installation.

### 3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

### 3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions and ANSI A117.1.
- B. Install plumb and level, securely and rigidly anchored to substrate.

### 3.4 SCHEDULE (See drawings for locations).

- |     |   |                             |
|-----|---|-----------------------------|
| 1.  | Toilet Paper Dispenser – Double Roll          | Bobrick B-2740              |
| 2.  | Waste Receptacle                              | Bobrick B-277               |
| 3A. | Grab Bars (Toilet):                           |                             |
|     | a. 36" Grab Bar                               | Bobrick B-6806-36           |
|     | b. 42" Grab Bar                               | Bobrick B-6806-42           |
| 4.  | Sanitary Napkin Disposal                      | Bobrick B-35303             |
| 5.  | Robe Hook:                                    | Bobrick B-76717             |
| 6.  | Baby Changing Station                         | Koala Kare KB-200-0155 Grey |
| 7.  | Mop Rack w/shelf                              | Bobrick B-224 x 30          |
| 8.  | Mirrors (W x H)                               |                             |
|     | a. 7'-6" x 3'-6"                              | Bobrick B-1556 2436         |
| 9.  | Washbar (Soap, water & hand dryer)            | Bradley LVQD3               |
|     | (to be used with Evero Basin, Color: Mykonos) |                             |

END OF SECTION

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SECTION 11 42 00  
COMMERCIAL KITCHEN EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES:

- A. Commercial Kitchen Equipment: For rough-in requirements refer to plan for equipment locations.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Division 23 - Mechanical: Connection of Utilities
- B. Division 26 - Electrical: Connection of Utilities

1.03 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01 33 00.
- B. Submit shop drawings indicating cabinetry, appliances and utility requirements.
- C. Submit product data under provisions of Section 01 33 00.
- D. Submit product data for dock guards, display cases, appliances, athletic equipment and projection screens.
- E. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.04 OPERATION AND MAINTENANCE DATA

- A. Submit operation data under provisions of Section 01 78 20.
- B. Submit maintenance data under provisions of Section 01 78 20.
- C. Include cleaning and stain removal methods and recommended cleaning materials, polishes and waxes.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00.
- B. Store and protect products under provisions of Section 01 60 00.

1.06 WARRANTY

- A. Provide Manufacturers' standard warranties under provisions of Section 01 77 00.
- B. Warranty: Include coverage for replacement parts and repair labor to correct defects in workmanship and materials. Provide a five (5) year warranty, parts and labor, on refrigerator.

## 1.07 SUBSTITUTIONS

- A. Substitutions shall be in accordance with Section 01 60 00.

## PART 2 PRODUCTS

### 2.01 COMMERCIAL KITCHEN EQUIPMENT (By others unless noted otherwise – Contractor to provide rough-in)

- A. Reach-In Refrigerator:
1. Model: Continental Refrigerator Model 1R
  2. Description: Refrigerator, reach-in, one-section, 20 cu. ft., self-contained refrigeration, stainless steel front, aluminum interior and ends, standard depth, full-height solid door, electronic control with digital display, hi-low alarm, electric condensate evaporator, 1/4 HP, cETLus, NSF, Made in USA.
  3. Warranty: Standard warranty: 3 year parts and labor, 5 year compressor
  4. 115v/60/1-ph, 5.5 amps, cord, NEMA 5-15P, standard
  5. Door hinge on right, standard.
  6. 5" casters, standard
  7. Quantity: One (1)
- B. Reach-In Undercounter Freezer:
1. Model: Continental Refrigerator Model SWF32-U
  2. Description: Undercounter Freezer, 32" W, 9.0 cu. ft. capacity, one-section, (1) field rehingeable door, stainless steel front, top and end panels, aluminum interior, 1-3/8" diameter plate casters, front breathing, electronic control with digital display, hi-low alarm, rear-mounted self-contained refrigeration, R290 Hydrocarbon refrigerant, 1/3 HP, cETLus, NSF, Made in USA.
  3. Warranty: Standard warranty: 3 year parts and labor, 5 year compressor
  4. 115v/60/1-ph, 5.6 amps, cord, NEMA 5-15P, standard
  5. Quantity: One (1)
- C. Range, 36", 6 Open Burners:
1. Model: Vulcan Model 36S-6B
  2. Description: Endurance Restaurant Range, ga, 36", (6) 30,000 BTU burners, lift-off burner heads, standard oven, stainless steel front, sides, backriser, and lift-off high shelf, fully MIG welded chassis, 6" adjustable legs, 215,000 BTU, CSA, NSF
  3. Warranty: 1 year limited parts and labor warranty, standard
  4. Gas type to be specified.
  5. Stainless steel backriser and lift-off high shelf, standard
  6. Quantity: One (1)
- D. Exhaust Hood: (By Contractor)
1. Refer to drawings.
- E. Underbar Sink Units:
1. Model: John Boos Model EUB3S72-2D
  2. Description: Underbar sink unit, 3-compartment, 72"W x 21"D x 32-1/2"H overall size, (3) 10"W x 14" front to back x 10" deep compartments, (2) 19" left and right ribbed drainboards, 3"H backsplash, (1) set of deck mount faucet holes with 4" centers, includes

faucet (PDF-4-D-10), raised marine edge on front and sides, stainless steel apron on front & sides, includes 1-1/2" drains and overflow stand pipes (PB-OVF-BS), 18/300 stainless steel construction, stainless steel legs and side bracing, adjustable plastic bullet feet, NSF, CSA-Sanitation (weights are subject to additional packaging).

F. Underbar Sunk Units:

1. Model: John Boos Model EUBS-1521STD
  - a. Model PBF-4SM2-5GLF Heavy Duty Faucet, shallow splash mounted, 4" centers, 5" gooseneck spout, with 1/2" NPT (LEAD FREE FAUCET)
  - b. Model PB-WL-36 Flexible water line connectors for shallow mount faucets, (2) houses per kit, (1) red for hot and (1) blue for cold.
2. Description: Underbar Dump Sink, freestanding, 15"W x 21"D x 33-1/2"H overall size, (1) 10"W x 12" front to back x 6" deep compartment, 4"H backsplash, (1) set of splash mount faucet holes with 4" centers, deck mount soap dispenser, front and end panels, aluminum back and interior, electronic control with digital display, hi-low alarm, rear mounted self-contained refrigeration, 1/5 hp, cETLus, NSF, Made in USA.

G. Sandwich/ Salad Preparation Refrigerator:

1. Model: Continental Refrigerator Model SW27-8
2. Description: Sandwich Unit, 27"W, 7.4 cu. ft. capacity, one-section (8) 1/6 size x 4" deep pans with 12" cutting board, (1) field rehingeable door, stainless steel top, front and end panels, aluminum back and interior, electronic control with digital display, hi-low alarm, rear mounted self-contained refrigeration, 1/5 hp, cETLus, NSF, Made in USA.
3. Warranty: Standard warranty: 3 year parts and labor, 5 year compressor
4. 115v/60/1-ph, 6.3 amps, cord, NEMA 5-15P, standard
5. Casters, 5" standard
6. Quantity: One (1)

H. Ice Cuber with Bin:

1. Model: Manitowoc Model UDF-0140A
2. Description: NEO Undercounter Ice Maker, cube-style, air-cooled, self contained, 26"W x 28"D x 38-1/2"H, production capacity up to 135 lb/ 24 hours at 70°/50° (95 lb AHRI certified at 90°/ 70°), 90 lb ice storage capacity, electronic controls, dice size cubes, 6" adjustable legs with flanged feet (painted gray), 0.42 HP, NSF, cULis, CE
3. Model WARRANTY-ICE-SC 3 year parts and labor (Machine), 5 year parts and labor (Evaporator), 5 year parts and labor (Compressor), standard.
4. Model AR-10000 Artic Pure Primary Water Filert Assembly, includes head, shroud, hardware, mounting assembly, and (1) filter cartridge, 14,000 gallon capacity, 0-600 lbs./ ice per day.
5. Model WARRANTY-ARCPURE 3 year parts and labor warranty on cap, housing, hardware, and mounting assembly (does not refer to filter cartridge), standard.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that openings are ready to receive work.
- B. Verify field measurements are as shown on shop drawings.

- C. Verify that required utilities are available, in proper locations, and ready for use.
- D. Beginning installation means installer accepts existing substrate conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.03 CLEANING

- A. Clean work under provisions of Final Cleaning.

3.04 PROTECTION

- A. Protect finished installation under provisions of Section 01 50 00.

END OF SECTION

SECTION 12 20 00  
WOVEN ROLLER SHADES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Manually operated roller shades.
- B. Products Supplied but Not Installed Under This Section:
  - 1. Metal shade pockets or housings recessed into ceiling system or assembly.
  - 2. Extruded aluminum ceiling pocket trim (closure) assemblies.
- C. Related Sections:
  - 1. Section 06 11 40 - Wood Blocking and Curbing: Blocking for support of window shade brackets or pocket assemblies.
  - 2. Section 08 41 00 - Aluminum Framed Storefronts.
  - 3. Section 08 44 13 - Glazed Aluminum Curtainwall
  - 4. Section 09 26 00 - Gypsum Board Systems: Substrate for window shade systems and installation of shade pockets, pocket closure and/ or accessories supplied only under this section.

1.2 PERFORMANCE REQUIREMENTS

- A. Fire: Provide shade fabrics tested in accordance with:
  - 1. 1989 NFPA 701 small scale Vertical Burn Test and rated "PASS."
  - 2. 1996 NFPA 701 small scale Vertical Burn (telephone booth test) and rated "PASS."
- B. Toxicity: Provide shade fabrics tested in accordance with University of Pittsburgh Toxicity Protocol including LC50 analysis and toxicity characteristics.
- C. Anti-microbial:
  - 1. ASTM G-22-80 results for ATCC6538 (*Staphylococcus aureus*) and ATCC13388 (*Pseudomonas aeruginosa*) indicating minimum 5mm (0.197 inches) 'No Growth Contact Area'.
  - 2. ASTM G-21-85 results for ATCC9642, ATCC9644, ATCC9348 and ATCC9645 indicating 'No Growth'.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets, performance data, and installation instructions for each item required per section 01 33 00.
- B. Shop Drawings:
  - 1. Interior Elevations at 3/8" = 1'-0" scale min indicating shade layout, seam / batten locations and coordination with surrounding conditions.
  - 2. Floor plans or reflected ceiling plans showing overall arrangement of shades and control locations.
  - 3. Head, Jamb and sill details as necessary to coordinate work with surrounding conditions and construction.
  - 5. Shade schedule coordinating room number, window type, opening size(s), quantities and key to details.

- C. Samples:
  - 1. Selection samples:
    - a. 3" X 5" (76 mm x 127 mm) shade cloth fabric swatches for initial fabric color selection from manufacturer's full range of available fabrics.
    - b. Standard aluminum finish color samples from manufacturer's range of standard colors.
  - 2. Verification samples:
    - a. One fully operational window shade sample of each type required 30" X 30" (760 mm x 760 mm) complete with selected shade cloth including sample of seam / batten when applicable. Disassemble sample to demonstrating compliance with PART 2.
    - b. One complete set of all shade components, unassembled, demonstrating compliance with PART 2.
- D. Design Data, Test Reports, Certificates: Current reports from independent testing laboratories demonstrating compliance with article 1.2.
- E. Manufacturers' Instructions: Manufacturer's standard installation instructions.

#### 1.4 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Manufacturer: 20 years minimum experience manufacturing products comparable to those specified in this section.
  - 2. Installer: 20 years minimum experience installing products comparable to those specified in this section.
- B. Field Samples: Install large size sample of selected fabric for final verification of color, weave and density, in opening as directed by design professional.
- C. Do not fabricate shades without obtaining field dimensions for each opening. Coordinate construction of surrounding conditions to allow for timely field dimension verification.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection:
- B. Do not deliver items to the project until all concrete, masonry, plaster, painting and other wet work has been completed and is dry.
- C. Deliver shades to project in labeled protective packaging. Uniquely labeled to identify each shade for each opening. Schedule delivery to prevent delays to completion of work but to minimize on site storage time.
- D. Store materials in a dry secure place. Protect from weather, surface contaminants, corrosion, construction traffic and all other potential damage.

#### 1.6 WARRANTY

- A. Special Warranty:
  - 1. Manual Operating Components: Provide Manufacturer's warranty under provisions of Division 1 - General Requirements. Warranty period to be **10 years** from Date of Substantial Completion and contain provisions that installation is to remain operational without fault for the warranty period and include all operating parts, including shade cloth, except for the bead chain which is not covered by the warranty and is deemed to be a maintenance / service item.

2. Installation: Provide Contractor's warranty under provisions of Division 1 - General Requirements that installation shall be free from defects for a period of not less than 2 years after substantial completion.
3. In the event of a warranted product failure, the Shade Contractor will, at no cost to owner, facilitate acquisition and delivery of all necessary components to the owner.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Mechsystems Inc. (Basis of Design)
- B. Hunter Douglas
- B. Mechoshade Systems, Inc.
- C. Substitutions: Under provisions of Section 01 60 00.

### 2.2 SHADE BANDS

- A. Shade Bands: Construction of shade band includes the fabric, the enclosed hem weight, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
  1. Concealed Hembar: Shall be continuous extruded aluminum for entire width of shade band and with the following characteristics:
    - a. Hembar shall be heat sealed on all sides.
    - b. Open ends shall not be accepted.
  2. Shade Band and Shade Roller Attachment:
    - a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.
    - b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
    - c. Mounting Spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
    - d. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets, does not meet the performance requirements of this specification and shall not be accepted.

### 2.3 ROLLER SHADE FABRICATION

- A. Fabricate shade cloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design.
- B. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shade bands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

- C. For railroaded shade bands, provide seams in railroaded multi-width shade bands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shade bands
- D. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shade bands.
- E. Blackout shade bands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 3 feet (115 mm) on center extending fully into the side channels. Battens shall be concealed in an integrally colored fabric to match the inside and outside colors of the shade band, in accordance with manufacturer's published standards for spacing and requirements.
  - 1. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.

## 2.4 ROLLER SHADE COMPONENTS

- A. Access and Material Requirements:
  - 1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
  - 2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
  - 3. Use only Delran engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester shall not be accepted.
- B. Manual Operated Chain Drive Hardware and Brackets:
  - 1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
  - 2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
  - 3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
  - 4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
  - 5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
  - 6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable.
  - 7. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.



8. Drive Bracket / Brake Assembly:
  - a. MechoShade Drive Bracket model M5 shall be fully integrated with all MechoShade accessories, including, but not limited to: SnapLoc fascia, room darkening side / sill channels, center supports and connectors for multi-banded shades.
  - b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.525 mm) steel pin.
  - c. The brake shall be an over running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.
  - d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
  - e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
9. Drive Chain: #10 qualified stainless steel chain rated to 90 lb. (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

## 2.5 SHADECLOTH

- A. Visually Transparent Single-Fabric Shadecloth: MechoSystems, EuroTwill®, "Reversible, BrokenTwill", "6450" Series: 0.010 diameter (0.254 mm), Opaque, non-raveling vinyl/polyester yarn, fabric thickness 0.025 inches (0.635 mm).
  1. Dense BrokenTwill Weave "6450" series, 3 percent open.
  2. Color: Selected from Manufacturers standard colors.

## 2.6 ROLLER SHADE ACCESSORIES

- A. Fascia:
  1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
  2. Fascia shall be able to be installed across two or more shade bands in one piece.
  3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
  4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrate and conditions for installation. Do not commence installation until conditions are satisfactory. Commencement of installation indicates acceptance of site conditions by Contractor. Notify the Design Professional upon inspection when the project conditions are unacceptable for shade installation. "Beginning of installation" means acceptance of substrate and project conditions.

### 3.2 INSTALLATION

- A. Install units to comply with the Manufacturer's instructions for the type of mounting and operation required. Provide units plumb, true, and securely anchored in place with recommended hardware and accessories to provide smooth operation without binding.

- B. Install units within the following tolerances:
  - 1. Maximum variation of gap at window opening perimeter: 1/4 inch, per 8 feet (+/- 1/8 inch) of shade height.
  - 2. Maximum offset from level: 1/16 inch per 5 feet of shade width.

### 3.3 ADJUSTING

- A. Adjust drive / brake mechanism of units for smooth operation. Adjust shade and shadecloth to hang flat without buckling or distortion. Replace any units or components which do not hang properly or operate smoothly.

### 3.4 CLEANING

- A. Touch up damaged finishes and repair minor damage in order to eliminate evidence of repair. Remove and replace work that cannot be satisfactorily repaired.
- B. Clean exposed surfaces, including metal and shadecloth, using non-abrasive materials and methods recommended by the Shadecloth Manufacturer. Remove and replace work which cannot be satisfactorily cleaned.

### 3.5 DEMONSTRATION

- A. Demonstrate operation method and instruct Owner's personnel in the proper operation and maintenance of the window shade systems.

### 3.6 ROLLER SHADE SCHEDULE

- A. Roller Shade Schedule:
  - 1. Room 129-Conference and Room 128-Office.

END OF SECTION

# **TECHNICAL PROVISIONS**

## **VOLUME II OF II**

### **TERMINAL BUILDING EXPANSION**

**BID NO. PUR – 1436**

**FAA AIP. 3-24-0019-059-2018 (DESIGN)**

**MAA-GR-19-009 (DESIGN)**



### **HAGERSTOWN REGIONAL AIRPORT – RICHARD A. HENSON FIELD HAGERSTOWN, MD**

*Prepared For:*

### **THE BOARD OF COUNTY COMMISSIONERS OF WASHINGTON COUNTY MARYLAND**

*Prepared By:*



**AIRPORT DESIGN CONSULTANTS INC  
6031 UNIVERSITY BLVD SUITE 330  
ELLCOTT CITY, MD 21043**

**JULY 2019**

### **BID DOCUMENTS**

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**BID NO. PUR-1436**  
**AIP 3-24-0019-059-2018 (DESIGN); MAA-GR-19-009 (DESIGN)**  
**INVITATION TO BID**  
**ISSUED ON BEHALF OF**  
**THE BOARD OF COUNTY COMMISSIONERS**  
**OF WASHINGTON COUNTY, MARYLAND**  
**BY**  
**THE WASHINGTON COUNTY PURCHASING DEPARTMENT**  
**100 WEST WASHINGTON STREET, ROOM 320**  
**HAGERSTOWN, MD 21740-4748**  
**PHONE: 240-313-2330 / FAX: 240-313-2331**

**DATE ISSUED: July 2019**

**HAGERSTOWN REGIONAL AIRPORT TERMINAL BUILDING EXPANSION**

**PRE-BID CONFERENCE DATE/  
TIME AND LOCATION:**

**Wednesday, July 24, 2019 at 1:30 P.M., (EST)**  
Hagerstown Regional Airport  
Terminal Conference Room  
18434 Showalter Road  
Hagerstown, MD 21742

**DEADLINE FOR QUESTIONS:**

No later than **4:00 P.M. (EST), Wednesday July 31, 2019**

**SUBMIT BIDS TO:**

Washington County Purchasing Department  
Washington County Administration Complex  
100 West Washington Street  
Third Floor, Room 3200  
Hagerstown, MD 21740-4748

**BID SUBMISSION DEADLINE  
AND BID OPENING TIME:**

No later than **2:00 P.M., (EST), Wednesday, August 7, 2019**

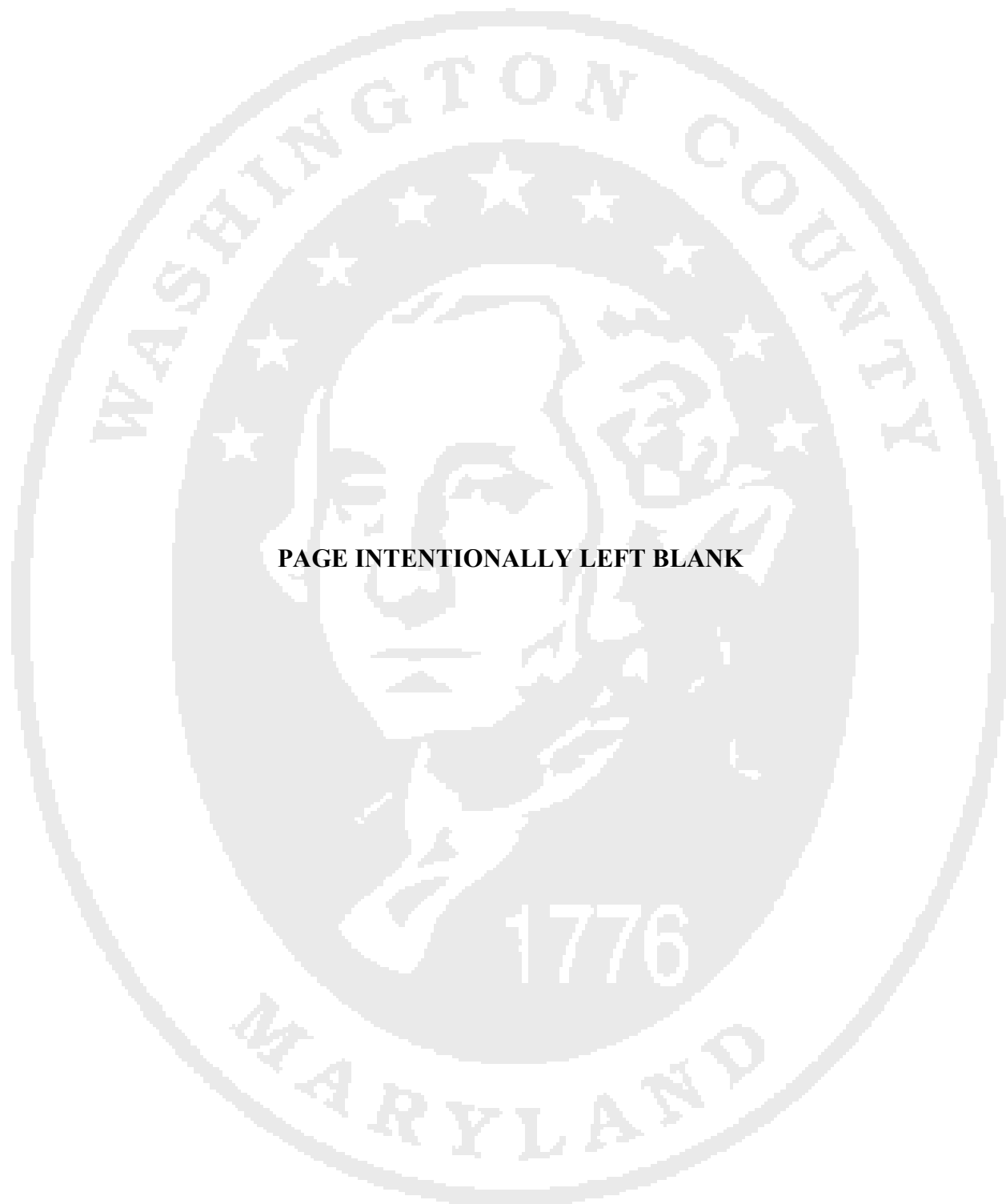
**BID OPENING LOCATION:**

Washington County Administration Complex  
Conference Room 2001  
Second Floor, 100 West Washington Street  
Hagerstown, MD 21740-4748

If indicated below (✓) and not waived by the County, Bidders shall be required to provide the following:

- ✓ A Bid Bond, in the amount of five (5%) percent of the bid on a bid of \$100,000 or more for construction contracts. See "Bid Bonds – Section 2" of the General Conditions and Instructions to Bidders.
- ✓ A Performance Bond for a bid award of \$100,000 or more on construction contracts. See "Bid Bonds – Section 2" of the General Conditions and Instructions to Bidders.
- ✓ A Labor and Material Bond for a bid award of \$100,000 or more on construction contracts. See "Bid Bonds – Section 2" of the General Conditions and Instructions to Bidders.

**BID DOCUMENTS**



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## **SECTION 5 TECHNICAL SPECIFICATIONS**

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## SECTION 220499 – PLUMBING SCOPE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. Force and effect as if printed herewith in full.

#### 1.2 DESCRIPTION OF WORK

- A. The work to be performed under these Specifications shall include providing all labor, materials, and equipment necessary to furnish and install, complete, properly, and fully all plumbing work as shown on the Drawings or herein specified. It is the intent of these Specifications that a complete operating system be installed; this Contractor shall carefully examine the site, drawings, and Specifications, and shall include all items necessary to accomplish this purpose. The work, in general, shall include, but shall not be limited to the following:
  - 1. Provide storm drainage systems as indicated. Extend storm sewers 5'-0" outside of exterior walls, for extension under the Site Contract. Final connections by the Plumbing Contractor. Provide roof drains.
  - 2. Provide interior sanitary and vent drainage system as indicated, including floor drains, cleanouts, traps, and vents.
  - 3. Provide interior domestic hot and cold water distribution systems as indicated. Provide valves and backflow preventers.
  - 4. Provide interior/exterior natural gas distribution system as indicated. Provide valves, pressure regulators, and roof pipe supports.
  - 5. Provide domestic hot water heating equipment.
  - 6. Provide plumbing fixtures and equipment shown.
  - 7. Provide wet fire protection systems for areas indicated.
  - 8. Provide plumbing services and final connections for equipment furnished under various Contracts or by the Owner as indicated.
  - 9. Provide insulation for piping and equipment as specified.
  - 10. Testing, adjusting and balancing all plumbing piping and equipment.
  - 11. Furnish combination starter/disconnects, magnetic starters, manual starters, and fused disconnect switches, to the Electrical Contractor for installation on all plumbing equipment. Coordinate all electrical requirements with the Electrical Contractor before ordering such equipment.
  - 12. Type "RK" fuses for the starter/disconnect switches shall be furnished and installed under the Plumbing Contract as specified. The Plumbing Contractor shall properly size and select overloads and disconnect switch fuses in accordance with the National Electrical Code requirements. The Plumbing Contractor shall furnish to the Electrical Contractor the equipment manufacturer's circuit protection data.
  - 13. All control and interlock wiring shall be by the Plumbing Contractor.

14. Provide all necessary demolition of existing piping, fixtures, and equipment as indicated.

### 1.3 WORK BY OTHER TRADES

- A. Cutting, patching, painting, electrical, plumbing, fire protection, etc., shall be done by the affected trade at this Contractor's expense for changes required in work already installed or work required by other trades for changes made by this Contractor in type or size of equipment purchased.

### 1.4 WORK NOT INCLUDED

- A. The following construction and equipment related to the work under this Contract will be provided by others:
  1. Openings in new roofs. (General Contractor)
  2. Openings in new exterior walls. (General Contractor)
  3. Furring around piping. (General Contractor)
  4. Final painting of interior surfaces. (General Contractor)
  5. Recesses and openings in construction for plumbing piping and equipment. (General Contractor) Chases for piping where specifically shown on the Drawings. (General Contractor)
  6. All electric power wiring to all electrically-operated plumbing equipment. (Electrical Contractor) The Electrical Contractor will be responsible for all power wiring and associated terminations to line and load side of equipment as well as mounting of all combination starter/disconnects, magnetic starters, manual starters, fused disconnect switches, etc. furnished by the Plumbing Contractor and external to equipment they are designated to serve, except where such items are factory installed as an integral part of the equipment. The Electrical Contractor will make final connections to all equipment as directed by the Plumbing Contractor.
  7. Roof drain flashing vent flashing, and roof gas pipe flashing in all new roofs. (General Contractor) Openings, patching, restoring, and flashing in existing roof by General Contractor at Plumbing Contractor's expense.
  8. Extension of site utility services from Plumbing Contractor's terminal pipe locations as indicated. (General Contractor) Final connections by the Plumbing Contractor.

## PART 2 – PRODUCTS

### 2.1 NOT APPLICABLE TO THIS SECTION

## PART 3 – EXECUTION

### 3.1 NOT APPLICABLE TO THIS SECTION

END OF SECTION 220499

## SECTION 220500 – BASIC PLUMBING MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 PLUMBING WORK

- A. These Specifications are issued to cover all work in connection with the complete installation of the plumbing work. Plumbing work is hereby defined to include work as herein specified and as shown on the Drawings issued in connection with this project. Any reference in these Specifications to the Contractor shall hereby be considered a reference to the Plumbing Contractor. Any reference or letting of work to subcontractors or manufacturers in these Specifications does not relieve the Contractor of his responsibility for the work, materials, and equipment under this Contract. The Plumbing Contractor is responsible for the work and performance of his subcontractors.
- B. Fire protection work shall also be included as part of the Plumbing Contract. All fire protection work shall be completed by a licensed, certified Fire Protection Contractor responsible to the Plumbing Contractor.
- C. The word “building” used throughout these Specifications shall be interpreted to mean the entire Building Complex.
- D. The actual runs and locations of all piping, equipment, and materials shall be determined at the site and shall be installed to meet the various conditions at the building. It is, however, the Contractor's responsibility to predetermine the exact locations of piping and equipment, and to notify the other contractors accordingly and prior to any installation to avoid conflict with other piping and equipment. Any changes necessary to conceal pipes or clear pipes and equipment of other trades shall be made without additional expense to the Owner.
- E. All work shall be executed and all equipment constructed and installed in accordance with the requirements of the Maryland Department of Labor and Industry, applicable IBC Codes, the Maryland Department of Environmental Protection, ASME, the Department of Labor, Safety and Health Regulations for Construction, OSHA, the National Fire Protection Association, the National Electrical Code as amended to date of bidding, and all applicable federal, state, county and local ordinances and regulations. Nothing contained in these Specifications or shown on the Drawings shall be construed to conflict with the aforesaid codes, ordinances, or regulations. Certificates of approval shall be obtained from any department issuing same and shall be turned over to the Owner at the completion of the work. All fees and permits required shall be satisfied and obtained by the Contractor and the cost shall be included in the Contract price.
- F. The Contractor shall carefully examine the general building drawings, all mechanical and electrical drawings, and carry on his work so as not to delay or interfere with the work of other

trades. The Contractor shall obtain in writing from the other contractors such data as is necessary to coordinate his work with other branches. This coordination must take place prior to any piping or equipment installation. As the work in the building nears completion, all threading, cutting, and similar work shall be done where directed by the Architect. Upon completion of the work, all remaining waste materials and rubbish resulting from the Contract work shall be removed from the building and premises.

- G. Where the phrase "or approved equivalent," "or equivalent," or "approved" appears in these Specifications, it shall refer to the prior to bidding approval of the Architect/Engineer on the material or equipment involved. Substitutions of non-named suppliers after bidding shall be summarily rejected.
- H. The term "Provide" means to furnish and install. The term "Furnish", used separately, means to obtain and deliver on the job for installation by other trades.
- I. The General Contractor will provide chases and openings in walls, floors, ceilings, and partitions of new construction to receive pipe piping, risers, and other equipment insofar as it is possible to predetermine the exact location, but the Contractor shall install his work sufficiently in advance of the building construction to permit his work to be built into place. The Contractor shall advise the General Contractor of the exact size and location of all chases and openings required for the installation of his work and shall check size and location of all such chases and openings provided by the General Contractor.
- J. The Contractor shall furnish and place all sleeves required for pipes passing through new floors, walls and ceilings before such general construction work is built into place. The Contractor shall place all inserts required for hangers and supports, as the construction work progresses, so that unnecessary cutting of construction work will be eliminated.
- K. Equipment and materials of similar types shall be of the same manufacturer unless specifically indicated otherwise on the Drawings or herein specified. The Contractor shall make final connections between all equipment furnished under this Contract and equipment furnished under other contracts, except as otherwise specified herein.
- L. The materials used throughout shall be those of reputable manufacturers and shall be the best of their respective kinds. All equipment, components and materials shall be installed in a neat and workmanlike manner in accordance with best trade practices, manufacturer's recommendations, and applicable codes and standards and by persons skilled in each particular branch of the work assigned to them. All work shall be installed subject to the approval of the Architect.
- M. All piping work shall be installed plumb, level, and square per code requirements. All piping shall be run in straight horizontal or vertical sections, outside of sloped drainage piping, and shall be under inspection during installation. Any piping, fittings, hangers, and/or systems deemed unacceptable per inspection during installation shall be repaired, replaced, and corrected with no additional cost to the project.
- N. A complete list of materials proposed for each installation shall be submitted to the Architect for approval before delivery to the site. The Contractor shall submit samples of materials for approval at the site as requested by the Architect. Such materials may be incorporated into the structures after serving their purpose as samples.

- O. Where the Contractor elects to substitute approved materials or equipment for materials or equipment specified, the Contractor will be held responsible for all architectural, structural, mechanical, and electrical changes required for their installation at no additional cost to the Owner. If additional engineering design is required, the Contractor shall reimburse the design engineer all costs.
- P. The Contractor shall be entirely responsible for all apparatus, equipment and appurtenances furnished by him or his Subcontractors in connection with the work, and special care shall be taken to protect all parts thereof in such manner as may be necessary or as may be directed. Protection shall include covers, crating, sheds, or other means to prevent dirt, grit, plaster, or other foreign substances from entering the working parts of machinery or equipment. Special care shall be taken to keep all open ends of pipes, etc., closed while in storage and during installation. Where equipment must be stored outside the building, it shall be totally covered and secured with heavy waterproof tarps and kept dry at all times. Where equipment has been subject to moisture, it shall be suitably dried out before placed in service. Rusted piping, interior or exterior of piping, will not be permitted for installation. Equipment with rusted finishes will not be permitted before or after installation. Materials and equipment shall be stored in areas designated by the Architect.
- Q. The Contractor or his subcontractors will not be permitted to use corridors as storage areas for their piping, materials, or equipment. Piping, materials, and equipment shall be stored in areas as coordinated with the Architect.
- R. Grades, elevations and locations shown on the Drawings are approximately correct; however, the Contractor shall field check and otherwise verify all such data at the site before proceeding with the work. The Contractor shall make necessary survey equipment available at all times and shall make use of such equipment wherever necessary to properly install his piping or equipment.
- S. The Contractor shall visit the site and thoroughly acquaint himself with conditions existing at the site before submitting his proposal as will be held responsible for the installation of the work complete in every detail. The Contractor shall especially review the Architect's phasing schedule and ensure compliance with this schedule.
- T. All work shown on the Drawings and not specifically included in the Specifications shall be considered a part of the Contract work. All work included in the Specifications and not specifically included on the Drawings shall also be considered a part of the Contract work.
- U. Carefully examine all Drawings and Specifications included under this Contract and Drawings and Specifications included under other contracts and report any discrepancies noticed to the Architect.
- V. Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, valves, access panels, adapters, and similar parts which may be required. The Drawings are diagrammatic generally indicative of the work to be installed. The Contractor shall carefully investigate the structural and finish conditions affecting the work and arrange all work accordingly, furnishing necessary parts and equipment as may be required to meet the various conditions.
- W. The Contractor shall layout his work from dimensions of Architectural and Structural Drawings and actual dimensions of equipment being installed. Layouts in congested areas should not be

scaled from Plumbing, Fire Protection, HVAC and Electrical Drawings. Clearances shall be provided on all sides of equipment as required for proper maintenance purposes and as required by the Maryland Department of Labor and Industry.

- X. The Contractor shall furnish the services of manufacturers' representatives for all equipment furnished under these Contract Documents. The amount of factory service provided by the Contractor shall be as normally recommended and furnished by the various equipment manufacturers unless specified otherwise. Testing of such systems and equipment shall be made under the direct supervision of competent authorized service representatives. Any and all expenses incurred by the equipment manufacturers' representatives shall be borne by the Contractor.
- Y. All equipment and materials shall be manufactured in accordance with national standards established by manufacturer's associations, engineering and testing societies, such as NBMA, NEMA, ASTM, AMCA, ASME, ANSI, ACI, FM, U.L., where such standards have been established. The standards shall be construed to mean their correct specifications and designations as amended, as of the date of bid opening.
- Z. When the installation is reported in writing by the Contractor to be complete and ready for acceptance, tests and inspection shall be made by the Contractor in the presence of the Architect to ascertain whether it complies with the Specifications and Contract, and upon its failure to do so, the Contractor shall at once remedy all defects and shortcomings and any additional tests that may be required shall be entirely at the Contractor's expense. All of the testing work shall be done when and as directed by the Architect before the system is accepted.
- AA. Include any excavation and backfill as required for work included under this Contract, as herein specified. Work shall conform to all applicable federal, state, county, and local regulations governing safety provisions at excavation sites.
- BB. The General Contractor will install insulation with vapor barrier in certain areas of the building. Where the building insulation or vapor barrier is broken due to the installation of piping and equipment, the Contractor shall properly repair all insulation and seal all openings with vapor barrier covering and vapor barrier adhesive, of types installed with the insulation.
- CC. The Architect reserves the right to revise locations of piping and equipment within the building, as long as sizes remain the same. The Contractor should include suitable allowance in his bid price for the above.
- DD. In all cases where equipment and materials are specified in the singular or plural number, it is intended that such reference shall apply to as many such items as are required to complete the installation.
- EE. Where piping or other equipment passes through fire or smoke barrier stops, walls, floors, or ceilings, this Contractor shall furnish and install sleeves and shall thoroughly seal openings around sleeves, pipes, and equipment with fire and smoke resistant materials. Materials shall be furnished by the Plumbing Contractor as required to maintain the fire rating of the walls, partitions, ceilings and floors in accordance with the requirements of NFPA, the Maryland Department of Labor and Industry, and other applicable codes.
- FF. All moving parts of equipment and appurtenances installed shall be properly lubricated by the Contractor.



- GG. The Contractor will be responsible for the completion of all work included under this Contract and shall employ skilled and qualified tradespeople as necessary to satisfy all work and trades.
- HH. All capped or plugged connections shall be suitable for permanent, gastight installations.

### 1.3 CODE COMPLIANCE

- A. All plumbing work and materials shall comply with all applicable codes. Energy conservation shall be provided for plumbing systems as described in The International Energy Conservation Code.

### 1.4 ROUGH-IN

- A. This Contractor shall verify roughing-in dimensions for all fixtures and equipment prior to roughing-in for such fixtures and equipment.

### 1.5 SHOP DRAWINGS

- A. Shop drawings submittals shall not be regarded as installation manuals. It is the responsibility of the Contractor to obtain installation recommendations from the manufacturer of each item of the equipment.
- B. This Contractor shall submit prints of shop drawings and manufacturers' data for approval in the manner prescribed. Refer to this section for "Required Submittals".

### 1.6 RESPONSIBILITIES OF BIDDERS

- A. Before ordering any material or doing any work, this Contractor shall verify all measurements at the site and shall be responsible for the correctness of same. Any differences encountered between the site measurements and those shown on the Drawings shall be submitted to the Architect for consideration before proceeding with the work.
- B. This Contractor is assumed to be skilled in the trade and is solely responsible for compliance with health and safety regulations, performing the work in a safe and competent manner, and installation procedures required for the work as outlined in these documents.
- C. This Contract is all-inclusive of the work indicated on the Drawings and herein specified, and no separate Contract work, supplementary labor or service will be provided by the Owner, except as otherwise noted on the Drawings or herein specified.
- D. If any part of the installation specified or shown on the Drawings to be executed under this Contract requires a trade or classification of mechanics other than is normally directly employed by this Contractor, it shall be expressly understood that this Contractor shall sublet or engage mechanics experienced in each explicit trade involved to execute the work for the Contractor.

1.7 SCAFFOLDING AND RIGGING

- A. This Contractor shall provide all the scaffolding required to do the work included in this Contract. All necessary precautions must be taken in high risk areas. Provide temporary rigging, as required, to install work.

1.8 DRAWINGS

- A. The drawings are intended to be diagrammatic and are based on one (1) manufacturer's equipment. They are not intended to show every item in its exact location, the exact dimensions, or all the details of the equipment. The Contractor shall verify the actual dimensions of any substituted materials and equipment to ensure that they will fit in the available space. All apparatus shall be located, and all pipes run in the manner and locations shown thereon as closely as conditions will permit, and deviations therefrom shall be made only with the consent of the Architect, and without additional charge to the Owner.

1.9 TEN-DAY PRIOR APPROVAL

- A. Any equipment or components proposed for this project, other than model numbers named in the bid documents, shall have pertinent submittal data and descriptive cover sheet submitted to the Architect ten (10) days prior to the bid date for inclusion in an addendum, if and when, reviewed and accepted for bidding.
- B. This is for pre-bid review and is not to be regarded as submittals required for construction.
- C. Bidder shall base the bid on items of equipment actually named in bid documents or addendums issued prior to bidding. Verbal acceptance will not be recognized unless verified in writing. It is the Bidders' responsibility to ascertain that all equipment has been accepted by requiring copies of the Architect's written acceptance from the Equipment Suppliers.

1.10 WARRANTIES

- A. The Contractor shall warrant that the materials and workmanship used in the erection of this installation are as herein specified, and he shall provide all labor and materials required to make good any defects in same which become apparent within one year from date of acceptance of beneficial, permanent use of completed work in writing, providing such defects are due to faulty materials or workmanship and not to misuse of apparatus by the Owner, its employees, or tenants. Certain equipment shall be warranted or guaranteed for longer than one year from date of final acceptance where specifically mentioned in these specifications. This warranty shall be in writing and shall include written copies of factory warranties and expiration dates on items of equipment where the warranty date might differ from the acceptance date. No warranty shall start before the acceptance date. The acceptance will be for complete sections. No partial acceptance will be approved.
- B. The equipment and materials manufacturers are expected to recognize that they are responsible for the failure of their products to perform in accordance with data furnished by them or their authorized representatives as well as misrepresentations of such data. When the products have been installed in accordance with the manufacturer's published or written instructions and

recommendations and such products fail, then the Contractor and the manufacturers are responsible for replacement of the products and all associated work and materials without additional cost to the Owner. This warranty applies to all items supplied on the equipment and not just those that are the product of the manufacturer.

- C. The Contractors' warranty shall include at least two (2) inspections of the system to repair and replace any items found to be defective during this period. The first shall be approximately six (6) months after the acceptance of the system and the second at the end of the first year.

#### 1.11 SHOP DRAWINGS AND SUBMITTALS

- A. Refer to Architect's Front End for submittal requirements.
- B. At the close of the job, prior to final review, five (5) bound copies of operations and maintenance (O&M) manuals shall be submitted by transmittal to the Engineer for review and acceptance. In lieu of hard copy O&M manuals, the Contractor may submit two (2) copies on CD format containing PDF files. O&M manuals, regardless of format, shall include the following:
  - 1. Equipment warranties.
  - 2. Contractors' warranties.
  - 3. Parts list and manuals for all equipment.
  - 4. Operating instructions (in writing).
  - 5. Written instructions on maintenance and care of the systems.
- C. Prior to the installation of any equipment or materials, submit shop drawings and manufacturer's data for the items listed in the Submittal Log (Attachment A) in accordance with the Contract Documents. Submittal Log (Attachment A) shall serve as the Contractor's checklist to assure the complete submission of all required shop drawings and manufacturer's data. Additionally, all equipment and materials furnished as part of this Contract shall be submitted for review regardless of whether it is listed on Submittal Log (Attachment A) or not.
- D. The submissions are the Contractor's documents, and the Architect's and Engineer's review or acceptance constitutes an acknowledgment that the documents have been submitted and nothing more. It is the Contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.
- E. Any deviations from the design documents must be clearly identified so that the Engineer may properly review such items. It shall not be the Engineer's responsibility to search out these discrepancies. If such changes are not properly flagged for the Engineer's review, the Contractor shall be completely responsible for all consequences said changes may result in on the project.
- F. Submit Record (As-Built) Drawings. Refer to Paragraph 3.3

#### 1.12 UTILITIES AND PROTECTION OF SERVICES

- A. Do not interrupt any utility or service without adequate previous notice and schedule.

- B. The Contractor shall, at his own expense, repair, replace and maintain in service any utilities, facilities or services (underground, overground, interior or exterior) damaged, broken or otherwise rendered inoperative during the course of construction. The material used by the Contractor shall be approved by the Architect.

#### 1.13 INSTRUCTIONS TO OWNER'S OPERATING PERSONNEL

- A. The Contractor and his subcontractors shall satisfactorily complete the systems so that they are functional and operating to the satisfaction of the Architect. All systems, their controls and their sequencing must be demonstrated to the satisfaction of the Architect.
- B. The Contractor shall furnish the services of qualified personnel, approved by the Architect and thoroughly familiar with the completed installation, to instruct the Owner's permanent operating personnel in the proper operation of all systems included under this Contract and the proper care of all equipment and apparatus. These services shall be furnished for a period of two (2) 8- hour days after the operation of the building has been taken over by the Owner.
- C. When instructions are provided under this Contract, the Contractor shall have in his possession three (3) copies of an identifying letter which shall list the names of the Contractor's qualified instruction personnel, including manufacturer's representatives and subcontractors that will be giving instructions. Likewise, on the same letter, spaces shall be provided for the Owner's personnel who will receive the instructions. After instructions have been given and received for each system, the Contractor's representatives and subcontractors shall sign and date the letter, and the Owner's personnel shall sign and date the letter acknowledging that they have received adequate instructions for operating and maintaining the systems and equipment. One (1) signed copy shall be delivered to the Owner, one (1) copy to the Architect, and one (1) copy shall be retained by the Contractor.
- D. It is the intent that the entire systems with their complement of equipment and auxiliary equipment operate properly in accordance with the design concept and functional intent. It is also the intent that the Owner be given complete instructions for the proper operation and maintenance of all systems.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. All products shall be first-line quality, of grade and type shown on the Drawings, and specified or equivalents accepted by the Architect in writing.
- B. All products shall be in current production with no notice having been given that this product is to be drastically changed, modified or discontinued from production.
- C. The Supplier, by submitting, certifies that the equipment being proposed is proper for the application intended and that it has the capacity called for on the Drawings or in the Specifications.

## 2.2 COMPLETE SYSTEM

- A. All products, materials, and accessories shall be furnished, and installed as required, for a complete system ready for the Owner's beneficial use.

## 2.3 EQUIPMENT AND MATERIALS DEVIATIONS

- A. When any material or equipment is identified on the drawings or in the Specifications by reference to a manufacturer's name or model number; it is intended to establish a required standard of design and quality; and it is not intended to limit competition.
- B. When the Drawings and/or Specifications indicate one or more manufacturers' names for materials or equipment, the Bidder may submit a bid based on materials or equipment of manufacturers not named but considered by the Bidder to be equivalent to the standard of design and quality specified; however, such substitutions must be accepted by the Architect as equivalent. If the Bidder elects to bid on a substitution without securing written consent of the Architect prior to receipt of the bids, then it will be understood that proof of compliance with the specified requirements is the direct responsibility of the Bidder, and no such materials or equipment may be purchased or installed without written acceptance.
- C. Bidders are advised to ascertain such acceptance from their Suppliers by requesting copies of acceptance in writing signed by the Architect from their Suppliers.
- D. Where the equipment's electrical characteristics (i.e. horsepower, wattage, voltage, amperage draw, etc.) deviate from the plumbing and/or the electrical design, it is the responsibility of the Plumbing Contractor to strictly coordinate all electrical requirements prior to submittal, to meet the specific electrical requirements without a change order. Confirmation of coordination shall be included with the appropriate submittal. No change orders shall be awarded due to lack of coordination between trades.

## 2.4 ELECTRICAL WORK FOR PLUMBING EQUIPMENT

- A. Electric Motors - All electrical motors furnished and installed under this Contract shall be manufactured by Reliance, General Electric, U.S. Motors, or approved equivalent, and shall be of the proper type and frame of the services involved in accordance with the NEMA and Equipment Manufacturer's recommendations. Motors shall be "energy efficiency" type with 1.15 service factor. Motor windings shall be all copper. Where possible, motors shall be permanently lubricated. Where motors must be lubricated, the manufacturer shall furnish the services of a representative to review the lubrication procedure with the Contractor and the Owner and turn over to both of them all of the necessary maintenance literature. Motors and installation shall conform to all applicable requirements of the National Electrical Code. Motors shall be suitable for across-the-line or reduced voltage starting as applicable in each instance. Furnish the Electrical Contractor with all motor data so the Electrical Contractor may size wiring. The Plumbing Contractor shall be responsible for any additional costs to the Electrical Contractor resulting from any changes in motor sizes initiated by the Contractor, from sizes scheduled on the Drawings. Motors located in conditioned space shall be selected for quiet operation and shall not produce an objectionable "Motor Noise" in the space.

- B. Manual Motor Starters - Manual motor starters (disconnect switches/thermal overload switches) shall be furnished by this Contractor, for installation by the Electrical Contractor, for single phase fractional horsepower (1/2 horsepower and smaller) motors, Square D, Allen-Bradley, Siemens, or approved equivalent. Furnish all motor electrical characteristics to the Electrical Contractor so the Electrical Contractor may size wiring. The Plumbing Contractor shall size the manual motor starter overload devices for the loads served.
- C. Magnetic Motor Starters - Full Voltage - Furnish and deliver to the Electrical Contractor for installation, combination full voltage magnetic starters and fused disconnect switches for all 3 phase motors with service factors of 1.15. Starters shall have three (3) current overload relays and low-voltage release. Starters shall be furnished with hand-off-automatic switch, red run light, overload reset, a set of extra auxiliary contacts consisting of one (1) normally open contact and one (1) normally closed contact and a control transformer with 120 volt fused secondary control circuit and fused primary circuit. Starter enclosure shall be NEMA Type 1 enclosures. Furnish Allen-Bradley Bulletin 512 starters, or equal as manufactured by Square D, Siemens, or approved equivalent. Disconnect switches shall be horsepower rated to match the horsepower of the motors plus 1.15 service factors connected thereto as required. Fuses shall be furnished and installed by the Plumbing Contractor as herein specified. Where starters are separately mounted, they shall be of the magnetic type as herein specified. All magnetic motor starters for motors connected to the normal/emergency electrical distribution system shall be furnished with an adjustable time delay unit. Time delay unit shall be capable of delaying motor starting from 0 to 180 seconds.
- D. Hand-Off Automatic (H.O.A.) Selector Switches - Furnish and install hand-off-automatic selector switches where shown or required and shall be the type that can be changed in the field from two positions and vice versa. Switches shall have padlocking attachment that will permit locking in either the manual or automatic positions. Switches shall be furnished with NEMA Type 1 enclosures where installed remote from starter. Furnish and install Allen-Bradley three (3) position switches, Bulletin 800S-R35X with 800S-N1 padlocking attachment, or equal as manufactured by Square D, Siemens, or approved equivalent.
- E. Safety Switches - Safety switches shall be furnished by the Plumbing Contractor for installation by the Electrical Contractor.
1. Safety switches shall be of the fusible type, quick-make, quick-break, in NEMA Type 1 sheet steel enclosure unless otherwise noted. Switches shall be horsepower rated, and of size and number of poles as indicated on the Drawings. Safety switches shall be of type having a direct mechanical linkage between contacts and operating handle. Safety switches shall be as manufactured by Cutler-Hammer, General Electric, Square D Company, or approved equivalent. Fuses for all switches shall be of the UL Class RK-1 Low Peak, as manufactured by the Bussmann Mfg. Division of the McGraw-Edison Company, or Little Fuse. Fuses for motors shall be sized to conform with the motor running current and in strict accordance with the recommendations of the fuse manufacturer.
  2. Where switches are located at the exterior of the Building or in wet locations, they shall be provided with NEMA 3R or 4 weather tight and weather resistant enclosures. Enclosures for switches located in hazardous areas shall be of the appropriate explosion proof type.
  3. Switches used as service entrance switches shall be Underwriters Laboratories listed, suitable for Service Entrance Equipment.

- F. Electrical characteristics shall be determined from the Drawings and Specifications and verified on the job.
1. All power wiring by Electrical Contractor; all control wiring by Plumbing Contractor, except as herein specified; refer to "Control Wiring", this section. All power wiring and connections for all motors, including starters, controllers, and breakers will be furnished and installed under the Electrical Contract.
  2. In general, rigid conduit or tubing for control wiring shall be used, but equipment that requires movement or that would transmit vibration to conduit shall be wired with flexible (liquid tight) steel conduit, not over eighteen (18") inches long. Provide surface raceways at finish locations.
  3. All equipment with control wiring shall be grounded with a green-covered ground wire run inside the conduit and connected to the equipment frame on one (1) end and to grounding system on the other end.
  4. All electrical work required in the Contract shall conform to all applicable requirements of Division 16 of these Specifications.
  5. The Plumbing Contractor shall employ an approved, licensed Electrical Subcontractor, fully qualified in the trade, to perform all electrical control work required under the Contract.
  6. This Contractor shall not run piping above motors, switchboards, or panelboards in accordance with the National Electrical Code, unless specifically indicated on the drawings to serve that area with fire protection. Before piping is installed, coordinate exact locations with the Electrical Contractor. Failure to comply with this requirement shall be cause for the piping to be removed and relocated at no additional cost to the Owner.

## 2.5 CONTROL WIRING

- A. Furnish and install control wiring as indicated on the drawings or as specified in various portions of the specifications. All control wiring is the responsibility of the Plumbing Contractor, who provides the particular equipment, except as herein specified.
1. The Electrical Contractor will extend control wiring from fire protection monitor (tamper) switches and flow indicators to the fire alarm system.
  2. The Electrical Contractor will extend control wiring from the fire alarm panel to the electric alarm bell.
- B. Control wiring, in general, shall mean "low voltage" wiring, such as 24 volt, 12 volt, and 6 volt wiring, and shall include the providing of all required motor controls, relays, pilot devices, all related raceway systems, all related conductors, and all final electrical connections other than three phase power connections.
- C. For 120V or 277V line voltage equipment provided under the Plumbing Contract, the Electrical Contractor will provide single phase feeders and make final connections.
- D. All control wiring shall be extended in conduit. Use "plenum wire" without conduit where runs are in conditioned spaces such as relief, air conditioned, or return plenums.

- E. Control wiring shall be run in conduit and shall be copper conductors provided with Type THHN or dual rated THHN-THWN insulation and protective covering, not less than No. 12 AWG, run in accordance with the National Electrical Code; and in general, conforming to Division 16 specifications for this project.
- F. Conduit above ground for control wiring shall be rigid steel conduit or electrical metallic tubing, run in accordance with the National Electrical Code; and in general, conforming to Division 16 specifications for this project.
- G. Conduit below ground or below slab for control wiring shall be Schedule 40 PVC, UL rated for 90 degrees C., run in accordance with the National Electrical Code; and, in general, conforming to Division 16 specifications for this project.

## 2.6 VIBRATION AND NOISE CONTROL

- A. Furnish and install vibration isolators, flexible connectors, and other safety measures to prevent noise and vibration from being transmitted to occupied areas.
- B. Following installation, make proper adjustments to eliminate excessive noise and vibration.
- C. All equipment shall operate without objectionable noise or vibrations within Noise Criteria Curves listed in Sound Control Fundamentals of the latest edition of the ASHRAE Handbook of Systems and Applications. Sound and vibration measurements shall conform to the ASHRAE Handbook of Fundamentals. If such objectionable noise or vibration shall be produced and transmitted to occupied portions of the building by apparatus, piping, or other parts of this work, any necessary changes, as approved by the Architect, shall be made without cost to the Owner. Noise levels shall conform to the requirements of OSHA.

## 2.7 TAMPERPROOF SCREWS

- A. All screws exposed to view on plumbing equipment installed under this Contract, such as on wall access panels, fixtures and trim, floor drains, cleanouts, water coolers, and similar equipment, shall be tamperproof type. Screws shall be vandalproof slot type, Holt head, Allen head, or similar types. Phillips head screws are not regarded as tamperproof.
- B. Finish of screws shall match the finish of equipment in which they are being installed.

## 2.8 ACCESS PANELS



- A. The Plumbing Contractor shall furnish factory-fabricated access panels for access to all concealed valves, shock absorbers, air vents, traps, trap primers, strainers, cleanouts, plumbing equipment, fire protection equipment, and other items where no other means of access is available. Access panels shall be of appropriate size but not less than 18", except as otherwise noted on the drawings, flush type, hinged to drop down and out, concealed hinge and vandalproof operated spanner head cam lock, stainless steel in tile work and prime coated sheet steel in plaster or acoustical tile of all types. The Plumbing Contractor shall deliver access panels to the General Contractor for installation. Exact locations of panels shall be determined by the Plumbing Contractor, but panels shall be located for a symmetrical appearance. Access panels are not required at lift-out removable tile ceilings.
- B. At locations where indirect waste access is required, access panel doors shall be louvered. Louvered panel doors shall be as manufactured by Cierra Products, or approved equivalent.
- C. At locations where access panels are installed in fire-rated construction, access panels shall contain the 1-1/2 hour fire-rated "B" label; and in addition, shall also be provided with layers of gypsum wall board in thicknesses which will supply additional fire ratings equal to the fire ratings of adjacent construction.
- D. Coordinate with the General Contractor on fire ratings of construction.
- E. Access panels shall be Cierra Products, Acudor, or Zurn.

## 2.9 SLEEVES AND ESCUTCHEONS

- A. The Contractor shall provide sleeves for all piping and equipment passing through walls, floors and foundations. Sleeves, in general, shall be constructed of Schedule 40 steel pipe. Space between pipe and sleeve shall be sealed with a fire stopping material. Sleeves are not required for vertical core-drilled holes (i.e. fixture drainage piping); however, openings shall be filled with firestopping. Sleeves for large sewer piping which may pass through grade beams shall be Schedule 40 PVC. Provide openings through grade beams in accordance with Architect's requirements.
- B. All sleeves shall be of sufficient size to allow continuous passage of insulation where required.
- C. Where pipe motion, due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe.
- D. Sleeve installations in exterior and designated interior walls, foundations and slab on grade floors shall consist of steel sleeves with the annular space between the carrier pipe and sleeve continuously filled with modular, mechanical type, inter-locking synthetic rubber links. Sleeves shall be Model WS and links, Model LS, all as manufactured by LINK-SEAL Division, Thunderline Corporation, Advance Products & Systems, Inc., or Metraflex.
- E. Sleeves through fire rated construction shall be sealed as specified under the "Fire Stopping" section of this Specification.
- F. Escutcheons, including at fixtures, floor, wall, and ceiling plates, shall be chrome, cast brass, setscrew type. Provide "deep type" escutcheons where required to conceal connections; use

split ring backup escutcheons beneath deep escutcheons for extra depth where necessary. For insulated pipes, the escutcheon shall surround the outside of the insulation.

## 2.10 FIRE STOPPING

- A. Seal openings of fire rated construction with a material or product that has been tested at an independent testing laboratory, such as UL, FM, etc. Fire stopping shall conform to ASTM E-814, UL 1479, or UL 2079, with fire ratings equal to or exceeding the fire rating of the construction involved (Refer to General Construction Documents). Fire stopping shall be UL classified, and shall be similar to RectorSeal Metacaulk, 3M brand Fire Barrier Penetration Sealing Systems, or Hilti. Fire stopping of this type shall also be utilized for openings through smoke/fire rated construction. Refer also to applicable International Building Code Standards.
- B. If desired by the Contractor and approved by local codes, the "Hydro Flame" pipe sleeving system will be acceptable, by Pre-sealed Systems, 3M, or Hilti. Penetration system shall be UL certified, a water/fire stop system, tested to ASTM E814. Flame Through/F-Rating: up to 3 hours. System shall be secure, waterproof, fire rated, smokeproof, protects against gases, prevents mold intrusion, and shall allow for pipe expansion and contraction.
- C. If desired by the Contractor and approved by local codes, the "Pro Set" water/fire stop piping penetration systems also may be utilized. Penetration systems shall be UL certified and shall be the "Pro Set" System A, System B, or System C, 3M, or Hilti.
- D. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, release agents, water repellents, and any other substances that may affect proper adhesion.
- E. Comply with manufacturer's recommendations for temperature and humidity conditions before, during, and after installation of firestopping.

## PART 3 - EXECUTION

### 3.1 WORKMANSHIP

- A. All work shall be performed by competent mechanics using proper tools and equipment to produce first-quality work. All work shall be neatly installed, accessible for maintenance, and complete with all accessories required.

### 3.2 ACCESSIBILITY

- A. All equipment shall be installed in such away that all components requiring access (control operators, motors, drives, belts, valves, etc.) are so located and installed that they may be serviced, reset, replaced or recalibrated, etc. by service people with normal service tools and equipment. If any equipment or components are shown in such a position that this Contractor cannot comply with the above, the Contractor shall notify the Architect.

### 3.3 RECORD (AS-BUILT) DRAWINGS

- A. The Contractor shall maintain a complete set of Contract Drawings at the site and shall record all deviations in his work (**in red ink or pencil**) from that indicated on the Contract Drawings. Deviations shall be clearly and accurately recorded so that the Engineer can prepare final record (as-built) drawings using the Contractor's marked-up drawings. Dimensions shall be recorded using permanent reference points such as columns, building walls and like items. These record drawings shall be submitted to the Architect prior to final acceptance.

### 3.4 FOUNDATIONS AND SPECIAL SUPPORTS

- A. For concrete bases for equipment included under this Contract, the Plumbing Contractor shall establish sizes and locations of the various bolts, together with the templates for holding these bolts in position. Anchor bolts shall be placed in steel pipe sleeves to allow for adjustment, with suitable plate at bottom end of sleeve to hold the bolt. Each piece of equipment designated to have a base shall have a concrete base of not less than four (4") inches high, which shall project four (4") inches on all sides beyond the equipment. Bases shall have greater depths of height where so noted on the drawings. Refer to "Concrete Work".

### 3.5 CODES, STANDARDS, AND REGULATIONS

- A. All materials and workmanship shall comply with all applicable codes, federal and state laws, Specifications, local and county codes and ordinances, industry standards, utility company regulations, NFPA, and NEC. In case of a difference between codes, Specifications, federal and state laws, local and county codes and ordinances, industry standards, utility company regulations, NFPA, and NEC, and the Contract documents, the most stringent shall govern. The Contractor shall promptly notify the Architect in writing of any such difference.
- B. Reference to the following codes shall mean:

<u>REFERENCE</u>	<u>DEFINITION</u>
ASTM	American Society for Testing Materials
NFPA	National Fire Protection Association
UL	Underwriters Laboratories, Inc.
NEMA	National Electric Manufacturers Association
ANSI	American National Standards Institute
IBC	International Building Code
IPC	International Plumbing Code
NEC	National Electrical Code

- C. Should the Contractor perform any work that does not comply within the requirements of the applicable building codes, state laws and federal laws, local and county codes and ordinances, industry standards, utility company regulations, NFPA, and NEC, the Contractor shall bear all costs arising in correcting the deficiencies.
- D. This Contractor is assumed to be skilled in the trade and is solely responsible for compliance with OSHA regulations, performing the work in a safe and competent manner, and in installation procedures required for this work. All supervision assigned to this project shall be experienced in this type of work. This Contractor's superintendent shall be designated as Safety

Inspector, unless the Contractor designates another person and notifies the Architect of this change.

### 3.6 PERMITS, FEES, TESTS AND INSPECTIONS

- A. The Contractor shall give all requisite notices, obtain and pay all deposits, permits, and fees, including connection fees, necessary for the installation, tests, and inspections of all work provided under this Specification, and included under this Contract. All tests shall be conducted in the presence of the Architect.

### 3.7 REVIEW BY ARCHITECT

- A. This Contractor shall notify the Architect at the following stages of construction so that the Architect may visit the site for review and consultation:
  - 1. When equipment installation starts.
  - 2. When ceiling installation will cover any work not reviewed.
  - 3. When any piping is to be permanently concealed by construction.
  - 4. When any piping is to be permanently concealed by backfilling of trenches.
  - 5. When testing is started.
- B. Should the Contractor fail to notify the Architect at the times prescribed above, it shall then be the Contractor's responsibility and cost to expose any concealed piping or demonstrate the acceptability of any part of the system. Any extra cost, caused by the removal of work by other trades, shall be borne by this Contractor, at no cost to the Owner.

### 3.8 EARLY START-UP

- A. This Contractor shall do all possible to see that the plumbing and fire protection equipment is connected with electrical power as early as possible, so that final testing can be started. Should this Contractor be ready for operation and power is not available, the Electrical Contractor and the Architect shall be notified.

### 3.9 CLEANING AND PAINTING

- A. Periodically remove from the building site all rubbish and accumulated materials.
- B. At the completion of the project, thoroughly clean all equipment and remove all trash, cartons, and similar debris from the area. Make any necessary corrections or repair/replace any damaged materials or equipment. Leave the entire systems in a thoroughly clean and orderly manner.
- C. Where welding of pipe destroys factory pipe coating, piping shall be repainted. Any finished surfaces that have been scratched or discolored shall be touched up or repainted with paint to match the original color, to the satisfaction of the Architect. If any part has been bent, broken or otherwise damaged, it shall be replaced new prior to final review.

- D. The following items of equipment and piping being furnished under this Contract shall be prime coated and finish painted by the Plumbing Contractor. Painting shall be in strict accordance with the requirements and recommendations of OSHA.
1. All equipment and piping installed outside the building exposed to weather, including on roof areas. Colors shall be as selected by the Architect. Finish paint cast iron roof drains of color selected by the Architect.
  2. All non-galvanized and unpainted support steel, brackets, hangers, and other miscellaneous metals, including in crawl spaces, tunnels, walkways, above ceilings, loft spaces, prefabricated floor trenches, mezzanine spaces, and accessible pipe spaces.
- E. Insulated piping is not required to be painted, unless requirements provided by the Owner and Architect. All Piping shall be painted in accordance with Owner and Architect requirements. Coordinate painting procedures and requirements prior to bidding. Painting of piping may include, but not limited to, the following:
1. All insulated piping and equipment exposed to public view.
  2. All uninsulated piping in Mechanical Equipment Rooms.
- F. Surfaces required to be finished painted shall be painted as follows:
1. All uninsulated piping shall be painted with one (1) coat of rust inhibitive red primer and one (1) coat of gloss enamel.
  2. All other ferrous metals shall be painted with one (1) prime coat of equipment and machinery primer and one (1) finish coat of gloss enamel.
  3. Coated cast iron or coated black steel piping need not be painted above ceilings; however, rusted or scraped piping shall be touched up, to keep a like new finish.
  4. All galvanized surfaces shall be painted with one (1) prime coat of galvanized steel primer and one (1) finish coat of gloss enamel. All aluminum surfaces shall be painted one (1) prime coat of aluminum primer and one (1) finish coat of gloss enamel. Paint shall be of types specifically made for these surfaces.
  5. All other copper and brass surfaces shall be painted with one (1) prime coat of zinc chromate primer and one (1) finish coat of gloss enamel.
- G. Color code and/or label all natural, gas piping per Gas Company's and/or Owner/Architect's requirements.
- H. Color code fire protection piping as specified. Paint exterior fire protection devices including exposed drains, of colors selected by the Architect.
- I. Paint shall be of colors selected by the Architect.
- J. Finish paint color samples shall be submitted to the Architect for approval.
- K. Paint shall be as manufactured by Glidden, PPG, Rust-Oleum, or Sherwin-Williams.
- L. All painting shall be done in a careful, neat and workmanlike manner with particular care being exercised to protect building equipment and finishes. All surfaces shall be thoroughly cleaned of rust, scale, dirt, grease, dust, and like items, and sanded so as to provide bond for new paint. The Contractor shall be entirely responsible for cleaning all surfaces and should evidence

appear to the Architect that the surface was not properly prepared, the Contractor shall remove paint, prepare surface and repaint as required at no additional cost.

- M. The Contractor shall be responsible for painting his piping and equipment installed in finished areas after these areas have received finish painting by the General Contractor or in areas where the General Contractor is not painting.
- N. Refer to "Plumbing Identification", Section 220553, for stenciling and labeling.

### 3.10 FINAL CONNECTIONS

- A. All equipment noted as furnished and installed by other contractors or by the Owner, that requires plumbing services, will be furnished and installed complete with trim by that party, except as herein specified. The Plumbing Contractor shall coordinate type and location of equipment, rough-in services noted or required and make final connections. Final connections shall include items such as drain tailpieces, "P"-traps, running traps, water, air, and gas shut-offs, interconnecting piping extensions, piping within and around cabinetry, combination waste assemblies where required, piping adapters, and like items.

### 3.11 MAINTENANCE

- A. Contractor shall be responsible for maintenance of all equipment and apparatus included under this Contract until final project completion.

### 3.12 PLUMBING PLANS

- A. The plumbing plans are intended to be diagrammatic and are based on one (1) manufacturer's equipment. They are not intended to show every item in its exact location, the exact dimensions, or all the details of the equipment. The Contractor shall verify the actual dimensions of any specified or substituted materials and equipment to ensure that they will fit in the available space. All apparatus shall be located as closely as conditions will permit and deviations therefrom shall be made only with the consent of the Architect and without additional charge to the Owner. The right is reserved by the Architect to make any reasonable changes in the location of the equipment prior to rough-in without invoking additional expense to the Owner.

### 3.13 QUESTIONS AND CLARIFICATIONS OF BID DOCUMENTS

- A. Bidders shall not rely on any verbal clarification of the drawings and specifications. Any questions or clarifications shall be referred to Engineer at least seven (7) working days prior to bidding to allow for issuance of an addendum.

### 3.14 CHANGE ORDERS

- A. If change orders are not justified or rejected repeatedly by the Architect and the Owner, the Contractor shall be required to reimburse the Architect and the Engineer for time spent in excess of eight (8) hours to review change orders that are not justified.

### 3.15 SUBSTITUTIONS

- A. Throughout the Specifications, types of materials may be specified by manufacturer's name and catalog number in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the bidder may assume the phrase "or approved equivalent," except that the burden is upon the bidder to prove such equality. If the bidder elects to prove such equality, he must request the Architect's approval in writing to substitute such item for the specified item, and shall submit supporting data, and samples if required, to permit a fair evaluation of the proposed substitution with respect to quality, serviceability and warranty. All data pertinent to the proposed substitution shall be submitted to the Architect at least 10 days prior to the bid date for evaluation and review purposes. If the Architect accepts the proposed substitution, an addendum will be issued to all bidders advising all bidders that this substitution will be acceptable from all bidders.
- B. Substitutions of equipment other than that specified must be very carefully checked to assure that no problems will occur due to dimensional differences, code requirements, connection points, weights, etc. Where the Contractor elects to substitute materials or equipment approved by the Architect for those specified, the Contractor will be held responsible for all architectural, structural, mechanical, and electrical changes required for the installation of the substituted materials at no additional cost to the Owner. All tests required to substantiate the equivalence of the material will be the obligation of the Contractor.
- C. When this Contractor desires to furnish equipment of a manufacturer other than that specified or intended, he shall include a complete specification of the substituted item, along with each submission copy of shop drawings, indicating the necessary modifications to the substituted product to satisfy the requirements of the Contract Specifications. Manufacturer's specifications shall be written as close as possible over the Contract Specifications and each paragraph shall bear the same paragraph number as the Contract Specifications so that close comparison can be made. All submissions will be rejected should they not include the comparison specification. Comparison specification shall be submitted for approval 10 days prior to the Bid Date. If prior approval is not obtained, no substitutions will be considered, and the Engineer reimbursed for time spent to reject and return such submission.
- D. The verification specification shall include the exact wording of the Contract Specification and the revised wording identified properly indicating all the deviations proposed. If no deviations are noted, the Contractor must furnish the material or equipment in accordance with the Contract Specifications.
- E. Should the Contractor elect to propose a substitution after the project has been awarded, the Contractor will be billed for the time spent by the Architect and his consultants in evaluating the proposed substitution. This billing shall occur whether the proposed substitution is accepted or rejected and shall be at the rate of the direct cost to the Architect times a 2.5 multiplier.
- F. The submissions are the Contractor's documents, and the Architect's and Engineer's approval constitutes an acknowledgment that the documents have been submitted and nothing more. It is

the Contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.

### 3.16 COORDINATION FOR CONTRACTORS

- A. The Contractor must arrange work to eliminate conflicts with work of other contractors. It is extremely important that fire protection piping not be installed unless directly coordinated with the HVAC Contractor's ductwork installations and other contractor's piping and equipment installations.
- B. Actual location of pipe and equipment shall be determined at site. IN GENERAL, ROUTINGS OF THE HVAC CONTRACTOR SHALL TAKE PRECEDENCE. Contractor shall confer with other contractors as to locations of pipes, ducts, electrical and equipment provided under their contracts, before erecting any work. In case of conflict, the Architect shall have the final decision, with no cost to Owner.
- C. Contractor shall furnish Electrical Contractor information on electrical requirements of equipment provided under Contract. Equipment connections shall be made in neat and workmanlike manner, placing equipment in proper operating condition, with provisions for maintenance or replacement. Equipment manufacturer's recommendations shall be followed for final connections.

### 3.17 FLASHINGS

- A. The General Contractor will furnish and install all new roof flashings for roof drains and vents. Roof gas pipe flashing will be completed in a similar fashion. The Plumbing Contractor shall provide wall and floor flashings as specified. All existing roof flashing shall be under this Contract.
- B. For interior floor drain installations and concrete slab concealment in above-floor slab locations, epoxy concrete grout shall be used as manufactured by Nor-Mar Enterprises, F-101 Ease-A-Crete, or approved equal. Refer to Drawing Details.

### 3.18 EXCAVATION AND BACKFILL

- A. The Contractor shall do all necessary excavation and backfill required for the proper installation of work under the Contract. Excavation and backfill shall be for work included under the Plumbing Contract, and such items as seeding, detectable strips in trenches, piping terminal ends, paving, and similar items described herein shall be directly coordinated with the Site Contractor prior to ordering or installation. Determine exact start/stop construction points and final connections before proceeding with the work.
- B. The excavation shall be unclassified. All excavation shall mean the removal of all materials necessary to obtain proper grade for all piping and work installed under the Contract.
- C. Unless noted otherwise in these Specifications, trenching shall be excavated 6" below pipe invert and backfilled with thoroughly mechanically tamped crushed stone having a maximum size of 1/2". After the work has been inspected and/or tested, the excavation shall be backfilled



around and up to 12" over the pipes with the same material as pipe bedding. The balance of the excavation/trenching shall be backfilled as follows:

1. Exterior seeded areas – Backfill shall be clean, unfrozen earth free of stones larger than 2". Backfill shall be up to the top soil level on seeded area excavation.
  2. Exterior paved areas – Backfill shall be 2RC stone up to the level of the pavement stone base.
  3. Interior Areas – Backfill shall be 2RC stone up to the level of the pavement stone base.
  4. In all cases, backfill shall be thoroughly mechanically tamped and placed in layers not exceeding 6" in depth. Compact each lift until a dry density is obtained, which is equal to or exceeds 95% "Proctor" for pavement areas and building slab on grade areas; 90% "Proctor" elsewhere. Maximum dry density shall be obtained by testing a representative sample of fill in accordance with ASTM D-1557. Submit laboratory test reports which shall indicate compliance with these Specifications. Tests shall be performed at the following locations and frequencies, or as otherwise directed by the Architect:
    - a. Paved and building slab on grade areas: In no case fewer than three (3) tests- at subgrade and at two (2) selected compacted fill and backfill layers.
    - b. Foundation wall backfill: In no case fewer than two (2) tests – at compacted initial and final backfill layers.
    - c. Trench backfill: In no case fewer than two (2) tests-at compacted initial and final backfill layers, at least one test for each 150 feet or less of trench length.
- D. The excavation shall be kept free of water. No piping, equipment or concrete shall be installed in water. The Contractor shall provide necessary pumping and drainage for the protection of the installation.
- E. All excavation or trenching which occurs under wall foundations shall be backfilled up to the level of the wall foundation using concrete as herein specified.
- F. Where ground is found to be unsuitable to support pipe, provide concrete cradles. When laying pipe in concrete cradles, deposit concrete full width of cradle continuously to bottom of pipe, before concrete is set, embed pipe evenly, deposit remainder of concrete and tamp in a manner to avoid disturbing pipe. Provide concrete bridging in trenches in roadways in strict accordance with utility company or sewer authority requirements.
- G. Any information on utilities, surface or sub-surface structures, roadways, piping or conditions presented on the contract drawings does not guarantee that these utilities, surface or sub-surface structures, roadways, piping or conditions shall be exactly as illustrated and described. It is the Contractor's responsibility to obtain and/or verify such information prior to construction in order that he may provide an installation in complete conformity with design intent of the project.
- H. The Contractor shall maintain the work safe to human life and property in conformance with all Local, County, State and Federal Safety Regulations.
- I. Any structures and existing services damaged in the course of the work shall be repaired by the Contractor in kind equal to or surpassing the existing installation.
- J. All excess excavation material shall be removed from the site, properly and legally disposed of, at an approved land fill area, unless arrangements are made with the Owner for on-site disposal.

3.19 SPECIAL ENGINEERING SERVICES

- A. In the instance of Mechanical and Control systems, such as all major and special equipment, controls, or similar miscellaneous systems and equipment, the installations, final connections and testing of such systems shall be made under the direct supervision of competent authorized service engineers who shall be employed by the respective equipment manufacturer and/or an authorized representative. Any and all expenses incurred by these equipment manufacturers' representatives shall be borne by the Contractor.

3.20 TESTS AND ADJUSTMENTS - GENERAL REQUIREMENTS

- A. The Contractor shall furnish all labor, material, and equipment necessary for performance of all tests required by any of the agencies having jurisdiction. Testing procedures shall be outlined hereinafter under the respective sections of these specifications.
- B. All tests shall be conducted in the presence of the Architect. No piping shall be concealed until the system has been approved.
- C. At the completion of the work, all equipment, valves, fixtures, fixture trim, mixing valves, regulators, hose bibbs, wall hydrants, sprinkler heads, etc., shall be adjusted for proper operation.
- D. The Contractor shall obtain certificates of approval, acceptance and compliance with regulations of all agencies having jurisdiction. Work shall not be deemed complete until such certificates have been delivered to the Architect.

3.21 EQUIPMENT GUARDS

- A. Equipment guards shall be provided for protection at all belts, chains, gears, or other moving parts of equipment and machinery installed under this Contract. Guards shall be made up of suitable structural shapes and heavy gauge steel welded together and attached to equipment by removable clips and bolts. Guards shall be neat and substantial and shall be securely attached to equipment. After fabrication, guards shall be cleaned of rust and scale and painted with one coat of metal primer followed by one coat of enamel to match the equipment. Guards shall be easily removable for maintenance and service of equipment. All equipment guards shall conform with ANSI/OSHA requirements.

3.22 CONCRETE WORK

- A. For each piece of floor mounted equipment shown or specified to have a concrete base or pier built on the new or existing floor slab, the Contractor shall install a floor slab of suitable size for the equipment to rest thereon. Each foundation shall extend 4" above the floor line (unless otherwise indicated on the Drawings) and shall extend a minimum of 4" on each side of the equipment. Conform with specific equipment manufacturer's recommendations for construction of bases and foundations in each instance.

1. Refer to "Excavation and Backfill" for interior concrete floor slab replacement, such as for new sewer work.

- B. Furnish and install all concrete work related to work included under this Contract. Construct concrete forms and bases for the equipment installed under this Contract. Bases and forms shall be of suitable dimensions for all equipment. All concrete work shall be constructed subject to the approval of the Architect.
- C. Bases shall be reinforced with 6 x 6 x #10 gauge wire mesh unless detailed otherwise and anchored through floor construction with 3/4" diameter bolts or rods. Anchor bolts for equipment shall be placed in base before equipment is set.
- D. Concrete shall attain a minimum compressive strength of 3,300 psi at the age of 28 days, unless otherwise specified or indicated on the Drawings, such as for manufacturer's precast concrete construction. Tests shall be made by an approved laboratory if in the opinion of the Architect the concrete is not satisfactory. All costs in connection with tests of concrete shall be borne by the Contractor.
- E. All materials used for plain and reinforced concrete and the measuring, mixing, handling, placing and curing shall conform to current specifications of the American Concrete Institute (ACI 304 and ACI 318-71). Cement shall be normal Portland cement, Type I or Type II, conforming to ASTM Designation C-150.
- F. Aggregates shall consist of sand of approved quality, crushed stone, and washed gravel conforming to ASTM Standard Specification Designation C-33 and shall be supplied from a source approved by the Architect. The maximum size of the aggregate shall be no larger than 1/5 of the narrowest dimensions between forms of the members for which the concrete is to be used, no larger than 3/4 of the minimum clear spacing between reinforcing bars. All water for concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.
- G. Slag in any form will not be permitted as an aggregate.
- H. Proportions shall be in accordance with American Concrete Institute Standard "Recommended Practice for the Design of Concrete Mixes ACI 211.1."
- I. Metal reinforcement shall be deformed steel bars, cold-drawn steel wire, or fabricated forms of these materials. All bars shall be deformed, intermediate grade new billet steel. These materials shall conform in quality to Standard Specifications of the American Society for Testing Materials of the following applicable titles and serial designations:

Bars

Billet-Steel Bars for Concrete Reinforcement \_\_\_\_\_ A 615

Rail-Steel Bars for Concrete Reinforcement \_\_\_\_\_ A 616

Wire

Cold Drawn Steel Wire for Concrete Reinforcement \_\_\_\_\_ A 82

Fabricated Materials

Fabricated Steel Bar Mats for Concrete Reinforcement \_\_\_\_\_ A 184

Welded Steel Wire Fabric for Concrete Reinforcement \_\_\_\_\_ A 185

- J. Forms shall be of steel or wood and shall conform to the shape, piping, grades and dimensions of the concrete. All formwork shall comply with ACI 347. They shall be sufficiently tight to prevent leakage of mortar and shall be properly braced and tied together so as to maintain the desired position and shape during and after placing concrete. Forms shall be removed in such a manner as to assure the complete safety of the structure. All exposed corners or edges shall be chamfered. All burrs, fins, irregularities of forming, or spillage shall be removed, and the surface float or trowel finished to a smooth straight surface.
- K. Concrete shall be integrally waterproofed with Rez-Seal, by Euclid Chemical Company, or approved equivalent additive.
- L. Water stops of plastic, as manufactured by Ryerson, or approved equivalent, shall be installed in all concrete joints and between pours.
- M. Any new piping routed below new or existing foundations shall be encased in concrete. Concrete shall extend a minimum as follows: to the underside of the foundation wall, on 1'-0" on each side of the interior and exterior foundation walls, and 1'-0" below the pipe. Concrete below piping shall be set on 2'-0" of 2RC, or equivalent, stone base.

### 3.23 MISCELLANEOUS IRON WORK

- A. Furnish and install all miscellaneous iron work including, but not limited to, piping hangers, piping anchors and guides, and all other equipment supports. All additional structural members shall be furnished and installed to support equipment without excessive stress or strain on the building construction. Structural beams and other structural members shall be furnished and installed under this Contract where the building steel is not available or capable of supporting or anchoring pipe piping and equipment.
- B. All equipment and materials furnished and installed under this Contract which are not mounted on bases or floors shall be securely attached and supported from the main supporting structure of the building by metal hangers, clamps and/or brackets. Metal hangers, clamps and/or brackets shall be of suitable design and of sufficient strength to properly and safely support the materials and equipment involved. Lag screws and bolts shall be used where required at wood construction.
- C. Materials - Structural steel members for the support of equipment installed under this Contract shall conform to ASTM Specifications A-36 and shall comply with the latest requirements of the American Institute of Steel Construction. Structural steel shall be of standard sections as given in the structural steel manufacturers' handbooks.
- D. Priming - All steel and iron work shall be primed with Rust-Oleum red primer, Glidden, PPG, Sherwin-Williams, or approved equivalent. Before priming, all metal shall be thoroughly cleaned free from scale, rust, and dirt.
- E. Anchors - The Contractor shall provide all anchors, bolts, screws, dowels, and connecting members and do all cutting and fitting necessary to secure the work to adjoining construction. Build in connecting members to masonry, concrete, and structural steel as the work progresses.

- F. Supports and Brackets - Supports and brackets shall be neatly constructed of structural shapes to adequately support the equipment intended. All supports must be approved prior to installation. Field conditions will regulate the type of support.

### 3.24 COORDINATION DRAWINGS

A. Coordination

1. Each Contractor shall familiarize himself with the drawings and specifications of all other contracts relating to this project and shall coordinate with and be held responsible for his Work which is affected by or dependent on, other contracts.
2. Each Contractor shall provide any dimension, coordination, sleeve, insert, embedded or built-in item, and/or information which is required to be built into, or to complete, the work of another contract in a manner consistent with the Approved Project Schedule. Any additional cost or delay damages arising from a contractor's failure to so furnish or provide shall be borne by that contractor.

B. Coordination Drawings and Procedures

1. Each Contractor shall prepare composite shop drawings and field installation layouts for his work as directed by the Architect to solve tight field conditions except as modified in Paragraph 3 below. Such drawings shall consist of dimensioned plans and elevations and shall give complete information, particularly to size and location of sleeves, attachments, openings, conduits, ducts, boxes and structural interferences.
2. These composite shop drawings and field installation layouts shall be coordinated in the field among the Contractors to verify the proper relationship to the work of other Contractors based on field conditions and shall be checked for accuracy and approved by the Contractors as directed by the Architect before submission to the Architect for final approval.
3. HVAC, Plumbing, Fire Protection and Electrical Work shall be coordinated as indicated by the following procedure. Each Contractor shall sign each coordination drawing after all work has been laid out and conflicts resolved. The preparation of coordination drawings and layout Work on the coordination drawings shall be performed at the site by each Contractor.
  - a. The HVAC Contractor shall prepare a drawing of each area, at a scale of 1/4 inch equal 1'-0", showing his work plan and elevation. The Architect/Engineer can provide CAD Backgrounds of the entire project to the HVAC Contractor for his use. The HVAC Contractor shall layout and show light fixtures on the drawings.
  - b. The drawings referred to in 3. a. above shall then be forwarded to the next succeeding Contractor for layout of their work in the field in the following order: (a) PLUMBING (b) FIRE PROTECTION; (c) ELECTRICAL; (d) INTERIOR CONSTRUCTION.
  - c. By use of color coding, each succeeding Contractor shall show his work on the referenced drawings and shall sign same to indicate his satisfaction that there is no interference between his work and that of other Contractors. Colors will be assigned by the Architect.
  - d. When all work has been shown and signed off, the HVAC Contractor shall forward each to the Architect for review and approval. Prints of approved transparencies shall be distributed to the Contractors by the Architect.

- e. The Architect shall print one (1) copy for each trade for use in the field.
- f. The color coded drawings shall be kept at the Architect's field office for future reference in the event of conflict between the trades. At the completion of the project, all color coded drawings shall be delivered to the Owner for his records.

C. Meeting

- 1. Coordination meetings to resolve interferences in the Work will be held at the site in an area to be provided by the Architect. Representatives of each Contractor shall be present at each meeting. Each Contractor shall provide all necessary resources to insure, that the coordination process described herein does not delay the Approved Project Schedule.

- D. Each Contractor acknowledges that there may be items of Work which have not been drawn, coordinated, clarified or specified with complete detail in the Contract Documents but which are required for the completion of the Work, as inferable from the Contractor Documents. Any such item, when identified as part of the development of the Work, shall be drawn, coordinated, clarified or specified by the Architect in a manner consistent with contemplated kind, quality and customary standards and provided to the Contractor. When such drawing, coordination, clarification or specification is approved by the Owner, the drawing, coordination, clarification or specification so approved shall thereupon be part of the Contract Documents and the item of Work shall be performed by the Contractor as part of the Work without further action or order of the Owner and without any increase in the Contract amount or time as if such drawing, coordination, clarification or specification were originally included in the Contract Documents.

3.25 COORDINATION DRAWINGS – UNDERGROUND WORK

- A. Prior to the start of construction, this Contractor shall prepare and submit to the Architect a complete set of reproducible drawings indicating the routings, sizes, and invert elevations of all underground plumbing piping and fire protection piping crossing through, under, above, and/or otherwise affecting subsurface footings and grade beams.
- B. Drawings shall be prepared in the same scale as the Architectural structural plans and shall illustrate all relevant foundation and underground plumbing piping and fire protection piping.
- C. Elevations and subsurface foundation crossings indicated on the Plumbing Contract Drawings are intended to assist the Contractor in developing his Bid Proposal. Specific dimensions, sleeve sizes where applicable, and elevations shall be determined by the Contractor shown on his Coordination Drawings.

3.26 MERCURY PROHIBITION

- A. The use of mercury as a component of any equipment installed as part of this work is strictly prohibited. Mercury substitutes shall be used in thermometers, switches, and other equipment, which might commonly contain mercury.

3.27 ACOUSTIC SEALING

- A. Seal openings of acoustic-rated ceilings, walls, floors, or other construction, or acoustic area separation requirements with a material or product specially made for these types of applications. Acoustical sealants shall be as manufactured by Arcat, Inc., Acoustical Surfaces, Inc., or American Acoustical Products. Refer to Architectural Drawings for acoustic sealing locations required.

### 3.28 CLEARANCE REQUIREMENT

- A. Ceiling areas directly below heating equipment must be kept clear of all piping, conduit, and other utilities, including fire protection components, to allow for unit access for servicing and/or removal. Refer to “Contractor’s Specific Note” shown on the drawings.

END OF SECTION 220500

### Submittal Log (Attachment A)

**Project Name:** \_\_\_\_\_

**CJL Project No.:** \_\_\_\_\_ **Trade:** \_\_\_\_\_

Engineer's Review: A = Reviewed, B = Rejected, C = Furnish as Corrected, D = Comments Attached

Contractor's Required Response: E = Confirm, F = Resubmit

No.	Specification Number	Description	Manufacturer	Date Received	Action Taken	Date Returned
	220500	O&M Manuals				
	220500	As-Built Drawings				
	220500	Pipe Specialties (Fire Wrap, Access Panels, etc.)				
	220529	Plumbing Hangers and Supports				
	220553	Plumbing Identification Labels				
	220700	Plumbing Insulation				
	220523	Domestic Water Valves				
	220523	Domestic Hot Water Return Balancing Report				
	221116	Domestic Water Piping and Fittings				
	221116	Domestic Water Pipe Accessories (strainers, gauges, etc.)				
	221316	Sanitary and Vent Piping and Fittings				
	221316	Sanitary Drains of all types				
	221316	Sanitary Cleanouts of all types				
	221316	Trap Primers / Trap Seals				
	221413	Storm Piping and Fittings				
	221413	Storm Drains of all types				
	221413	Storm Cleanouts of all types				
	221124	Natural Gas Piping and Fittings				



**Submittal Log (Attachment A)**

**Project Name:** \_\_\_\_\_

**CJL Project No.:** \_\_\_\_\_ **Trade:** \_\_\_\_\_

Engineer's Review: A = Reviewed, B = Rejected, C = Furnish as Corrected, D = Comments Attached

Contractor's Required Response: E = Confirm, F = Resubmit

	221124	Natural Gas Valves				
	221124	Natural Gas Regulators				
	221420	Complete Fire Protection System				
	224000	Plumbing Fixtures and Trim – Complete				
	221429	Hot Water Circulating Pumps				
	223300	Domestic Water Heaters & Accessories				

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## SECTION 220510 – PLUMBING RESTORATION AND RETROFIT

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 WORK IN PRESENT BUILDING AND AT THE SITE

- A. All work shall be coordinated with the work of other trades and shall be performed in accordance with the Schedule of Work of the General Contractor and as required by the Architect and the Owner.
- B. The General Contractor will remodel the Present Building in all areas shown on the Drawings. The Plumbing Contractor shall refer to the general construction drawings to determine the extent of the remodeling in each area. The Plumbing Contractor shall disconnect and remove existing plumbing no longer required and furnish and install new plumbing as shown, herein specified and as required to form complete, new systems. Plumbing removal shall include existing fixtures, equipment, piping, insulation, supports, hangers, structural supports, concrete pads, bases, foundations, piers, and like appurtenances or accessories unless noted or required to remain as part of the remodeled system.
- C. The Contractor shall visit the site to determine exact locations, sizes and quantities of present equipment and piping which must be removed or connected thereto. The Plumbing Contractor will be held responsible for the complete disconnection and removal of all existing systems and the installation of all new piping and equipment complete in every detail. The Contractor shall provide “Demolition/Renovation Notification” as required by the Maryland Department of Environmental Protection, Bureau of Air Quality Control.
- D. All domestic water branch piping shall be disconnected and removed as noted on the drawings and shall be removed in their entirety, back to the water main. Cap existing connection fittings in main, or cap existing branch valving if existing valves are approximately 6” from mains.
- E. Existing piping no longer required and concealed in walls, below floors, or above fixed ceilings and not interfering with new construction or remodeled work may remain and shall be capped, abandoned and rendered “dead”. All water piping, drain piping, medical gas piping, and other piping systems exposed to view as a result of related work under this Contract shall be disconnected and removed or relocated. Cap or plug existing water, medical gas, drain, and other lines as necessary to keep lines or equipment in operation.

- F. The Contractor shall arrange the new hangers and supports so that new piping and other equipment are not suspended from the same joists and structural members as present piping and equipment. Hangers and supports shall be arranged to distribute the weight of the new piping and equipment uniformly on the present structure. Additional new structural members shall be furnished and installed as necessary to safely support the new piping and equipment. After equipment or piping is removed, existing remaining equipment or piping shall be properly supported.
- G. At certain locations, existing piping and equipment shall be disconnected and removed, and new piping and equipment shall be furnished and installed under this Contract above existing ceilings. The Plumbing Contractor will be responsible for restoring the existing ceilings (and grid work) to their present condition where they are removed or damaged by the work included under this Contract, and when the ceilings are not being replaced with new ceilings by the General Contractor. Plumbing Contractor shall temporarily remove existing ceiling tile and grid work, and upon completion of the Contractor's work, the Contractor shall reset ceiling tile and grid work, replacing damaged tile/grid work in kind. The Plumbing Contractor shall also be responsible for repair work to all existing remaining ceilings, as required to maintain the fire ratings of the existing ceilings.
- H. The Contractor shall clean up the areas as the work progresses and remove all waste and debris daily or when directed. Immediately remove water present in the area resulting from the work.
- I. The Contractor shall perform all cutting and patching required for installation of new piping and equipment, and for the removal of present piping and equipment as herein specified. Cutting of concrete work shall be completed by the "saw-cut" method or shall be core drilled. Certain cutting and patching will be performed under the General Contract as specified under "Work Not Included". The Plumbing Contractor shall be responsible for maintaining the structural integrity of the Existing Building where areas such as load bearing walls, roofs, and floor construction are patched and repaired under this Contract. All patching shall be done subject to the approval of the Architect. The Plumbing Contractor will be responsible for entrance of all new equipment into the building, and for the removal of existing equipment from the building, and for the related cutting, patching and repairing of existing construction.
- J. Existing removed fixtures, fixture trim, flush valves, other valves, fixture carriers, wall hydrants, floor drains, hose bibbs, water heating equipment, copper piping and tubing, and other similar useful equipment and materials tagged by the Owner shall remain the property of the Owner and shall be loaded, handled, unloaded, and stored at the site by the Contractor where directed by the Owner and Architect. Equipment shall be stored as complete units with all associated accessories and auxiliary equipment. Equipment shall be disconnected and carefully removed under this Contract and shall be transported to the storage areas as directed. Equipment shall be stored in a neat and workmanlike manner, tagged and identified for future use. Equipment not desired by the Owner shall become the Contractor's property and shall be immediately removed from the site.

- K. Removed other piping, fittings, hangers, insulation, traps, sprinkler heads, toilet seats, structural supports, and other miscellaneous materials and equipment no longer required, or desired by the Owner, shall not be reused as part of the new installation, but shall become the property of the Contractor and shall be immediately removed from the site. The Plumbing Contractor shall give due consideration and credit in his proposal for present materials and equipment which will become his property. Existing removed equipment remaining the property of the Contractor shall be dismantled and cut in sections as required for removal from building.
- L. Provide and later remove temporary piping services and equipment as required to keep systems operating during construction.

#### 1.4 CUTTING AND PATCHING – NEW CONSTRUCTION

- A. All openings or chases required for the installation of the work in the building will be provided by the General Contractor, providing this Contractor notifies the General Contractor of the size and location of the required openings or chases in sufficient time before the work is closed in, so that the work of the General Contractor will not be delayed.
- B. If this Contractor fails to notify the General Contractor in sufficient time, this Contractor shall cut, patch, finish, and paint the openings at his expense.
- C. This Contractor shall set all sleeves, hangers and anchors required for his work and shall be responsible for their proper and permanent location.
- D. This Contractor shall seal all openings he has utilized in fire rated floors, ceilings or partitions after his work has been installed. The material used for sealing the openings shall have a fire rating equal to or greater than the rating of the floor, ceiling or partition material.

#### 1.5 CUTTING AND PATCHING – EXISTING CONSTRUCTION

- A. The Contractor shall do all cutting and patching for the removal of existing piping and equipment and the installation of new piping and equipment in the Existing Building. Certain cutting and patching will be performed under the General Contract as specified under “Work Not Included”. Also, coordinate all work with “Cutting and Patching” as outlined in Architectural Sections.
- B. New openings in roof, interior and exterior walls, floors, ceilings, and partitions for pipe piping, hangers, supports, and other equipment in the Existing Building shall be provided by this Contractor for the new and remodeled installation. New openings in the existing construction and repair of such openings for the entrance of new plumbing equipment into the building or for the removal of plumbing equipment from the building shall be included in the Plumbing Contract. All cutting, and patching required for existing roof work shall conform to the Roof Bonding Agency’s requirements. Contact the Agency for provisions regarding the work. Openings in existing roof shall be the responsibility of this Contractor. Openings and patching in existing roof will be completed by the Roofing Contractor at the Plumbing Contractor’s expense. Patch all fireproof roof deck penetrations.
- C. Wherever it becomes necessary to cut out any portions of roof, interior and exterior walls, floors, ceilings, or other portions of the building as may be required to perform the work under

this Contract, the Contractor shall do all necessary cutting and fitting, shall remove all excess material, and shall replace all damaged work, so as to leave the premises in a finished condition. No cutting shall be done which may in any way affect the building structurally or architecturally without first securing the consent and approval of the Architect. Any damage incident to cutting or other causes in the performance of this Contract shall be made good by replacement or repairs in a manner satisfactory to the Architect. The Contractor must use extra precaution so as not to disturb the bearing quality of existing walls or other construction.

- D. Where present equipment is removed, and unused openings remain in roof, walls, floors, ceilings, partitions, etc., the Plumbing Contractor shall properly patch all such openings to match their immediate surroundings, unless specifically shown to be included under the General Contractor's scope of work. Openings remaining in exterior brick construction shall be patched with matching brick, not just masonry concrete or cement, as directed by the Architect.
- E. All patching and repairing shall be done by workers skilled in this type of work and shall identically match present or new finishes. If identical materials are not available or cannot be used for existing construction, use substitute materials that match existing materials to the fullest extent possible with regard to visual effect and performance.
- F. All cutting performed under this Contract shall be done in a neat and workmanlike manner. The size of each new opening shall be kept to minimum size. The location of each new opening must be approved by the Architect before the opening is drilled or cut.
- G. Where existing ceilings and walls and similar construction are penetrated for the installation of new hangers, supports, and other equipment, the Contractor shall repair the openings with fireproof materials to maintain the fire rating of the ceiling or wall construction, or similar construction.
- H. The Contractor's attention is directed to the Architectural Drawings to determine areas in which the General Contractor will perform extensive remodeling work. All cutting, and patching shall be directly coordinated with remodeling work performed under the General Contract. This Contractor shall cooperate with the General Contractor in every manner in making the installations.

- I. Patching and repairing shall be done to match present construction and finishes in materials, color, and texture. Painting shall be as herein specified. All cutting, patching, repairing, and painting shall be performed by workers skilled in that type of work. All patching shall be completed to a neat, finished condition. Where the General Contractor applies new finishes, except painting, on existing walls, floors, ceilings, and similar locations, it will not be necessary for the Plumbing Contractor to apply finished patching and painting to the remodeled surfaces; however, the Contractor shall rough patch the areas for the final finish. Where the existing areas are to be repainted by the General Contractor, the Plumbing Contractor must repair his openings and provide a prime coat and one (1) finish coat of paint to be ready for the General Contractor's final coat of paint. The Contractor's attention is directed to the General Construction Drawings to determine exact locations where new finishes on walls, floors, ceilings, and similar locations will be provided under the General Contract. There will be many areas where the General Contractor is not performing any work. The Plumbing Contractor shall repair and finish all openings where the General Contractor is not providing new finishes. When providing final painting of patching areas, entire wall or ceiling shall be painted corner to corner and top to bottom so that the entire wall or ceiling is painted. Paint shall be good quality type, as manufactured by Glidden, Sherwin-Williams, PPG, or approved equivalent.

#### 1.6 DUST, DIRT, AND NOISE

- A. The Contractor shall do all cutting and patching and shall make all changes, relocations, and installations with a minimum of noise.
- B. All present and new equipment, floors, walls, etc., shall be adequately protected from dust and dirt caused by the work. Protection shall include suitable temporary barriers or coverings. The exterior and interior premises of the building shall be kept as clean as possible during construction. At no time shall the Contractor interfere with the normal operation of the building by allowing debris, etc., to remain on the premises. The Contractor shall use industrial type vacuum cleaners for removal of plaster, dust, etc. in the Building.

#### 1.7 SCHEDULE OF WORK AND CONTINUITY OF SERVICE

- A. It is the Owner's desire to maintain the operation of the existing building with a minimum of disruption; therefore, the Contractor shall closely coordinate the scheduling of his work as well as equipment deliveries with the Schedule of Work prepared by the Architect. The schedule of work may be revised periodically during the course of construction, but each revised schedule must be approved by the Architect.
- B. When it becomes necessary to interrupt any part of the operation of the plumbing system or fire protection system, the Contractor shall notify the Architect and Owner five (5) working days in advance of the proposed interruption. The plumbing system or fire protection system shall only be interrupted when absolutely necessary and at a time to conform to the Owner's schedule.
- C. Long interruptions of the plumbing system or fire protection system, due to faulty workmanship or improper scheduling of work will not be tolerated.

### PART 2 – PRODUCTS

2.1 NOT APPLICABLE TO THIS SECTION

PART 3 – EXECUTION

3.1 NOT APPLICABLE TO THIS SECTION

END OF SECTION 220510



## SECTION 220523 – DOMESTIC WATER VALVES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The valves for the domestic water systems shall be as hereinafter described in this section.
- B. Lead Free: Refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content  $\leq 0.25\%$  per Safe Drinking Water Act as amended January 4<sup>th</sup>, 2011 Section 1417. Valve requirements to meet all State and Local requirements.
- C. For fire protection system valves, refer to Section 221420.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 for ferrous valve dimensions.
  - 2. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF/ANSI 61 and/or NSF/ANSI 372 for valve materials for potable-water service. Valves for domestic water must be 3<sup>rd</sup> Party Certified.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set angle, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:

1. Maintain valve end protection.
  2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 GENERAL USE VALVES

- A. The domestic water supply system shall be fitted with valves at points specified or indicated on the Drawings. Provide minimum 3/4" hose end drain ball valves with vacuum breakers and threaded caps at all low points of the water system to provide for drainage.
- B. Lead Free silicon bronze (ASTM listed) valves shall be made with corrosion-resistant materials. Manufacturer shall provide third party certification tested in accordance with EN ISO 6509 regarding dezincification corrosion resistance and stress corrosion cracking.
- C. Valves shall be Bronze Valves, ball type, with threaded or solder ends, unless otherwise indicated.
- D. All valves for general use shall be Nibco Inc., Hammond, Milwaukee, Apollo, Stockham, Zurn, Wilkins, or Watts. All valves shall be designated for a minimum 125 pounds per square inch (S.W.P.), 200 pounds per square inch (W.O.G.).
- E. Bronze or brass valves, including check valves and balancing valves, shall be made to be "dezincification resistant", with metal components in the waterway, or not containing more than 15% zinc in their chemical makeup.
- F. The name or trademark of the manufacturer and the guaranteed working pressure shall be cast or stamped on the body, as well as 'Lead Free' marked handle.
- G. Valves in Insulated Piping: With 2-inch stem extensions:
  1. Ball Valves: With extended operating handle of non-thermal-conductive material that meets UL 2043 approved for inside air plenum, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
    - a. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO NIB-SEAL (-NS suffix in figure no.), handle extension or approved equal.
- H. Valve-End Connections:
  1. Flanged: With flanges according to ASME B16.1 for iron valves.
  2. Grooved: With grooves according to AWWA C606.
  3. Solder Joint: With sockets according to ASME B16.18.

4. Threaded: With threads according to ASME B1.20.1.
5. Copper Press: With sockets according to ASME B16.22/ASTM B75

I. Bronze Ball Valves

1. Two piece, full port, silicon bronze ball valves with the capability of accepting extended operating handles. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model T/S/PC-585-80-LF (-NS).
  - a. Standard: MSS SP-110 and ASME A1124.14
  - b. CWP Rating: 600 psig
  - c. Body Design: Two piece bronze with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.
  - d. Body Material: Silicon bronze (ASTM Listed), corrosion resistant.
  - e. Ends: Threaded, soldered or pressed.
  - f. Seats: Reinforced PTFE or TFE.
  - g. Ball & Stem: Silicon Bronze 'Lead Free' Material
  - h. Port: Full.

2.1 CHECK VALVES AND BACKFLOW PREVENTERS

- A. For condensate drain line "light spring" check valves, refer to Section 221413, "Condensate Drain System".

B. Silicon Bronze Lift Check Valves

1. 200 CWP, Lift Check Valves with Nonmetallic TFE Disc. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model T/S-480-Y-LF.
  - a. Standard: MSS SP-139
  - b. CWP Rating: 200 psig
  - c. Body Design: Vertical or Horizontal Flow
  - d. Body Material: Silicon Bronze (ASTM Listed), corrosion resistant.
  - e. Ends: Threaded or Soldered.
  - f. Disc: FTE

C. Silicon Bronze Swing Check Valve

1. 300 CWP, Bronze Swing Check Valves with Nonmetallic TFE Disc. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Model T/S-413-Y-LF.
  - a. Standard: MSS SP-139
  - b. CWP Rating: 300 psig
  - c. Body Design: Vertical (flow in upward direction) or Horizontal Flow
  - d. Body Material: Silicon Bronze (ASTM Listed), corrosion resistant.
  - e. Ends: Threaded or Soldered.
  - f. Disc: PTFE or TFE

D. Double Check Valve Backflow Preventers

1. For sizes 3/4" thru 2", Wilkins Model 350XL-S-FT, 'Lead Free', with full port quarter turn ball valves, integral male 45 degree flare SAE test fitting, Watts or Apollo. Valve shall include lever handle ball shutoffs, replaceable seats and seat discs, and test cocks. A stainless steel backflow preventer will be acceptable.
2. Dual Check Valves 1/4" thru 3/8", for equipment or ice machine supply piping, shall be Watts Series No. SD-2/SD-3, Wilkins, or Apollo, of 316 stainless steel body, corrosion-resistant, internal rubber components. Valve shall be certified to ANSI/NSF Standard 18, Manual Food and Beverage Dispensing Equipment. Model SD-3 includes an atmospheric port requiring extension of relief piping and shall be utilized wherever possible. Provide strainer ahead of either installation.
3. Dishwasher, Ice Maker, and Pre-Rinse Sink Dual Check Backflow Preventer shall be all bronze body, the Watts Series 007, Wilkins, or Apollo with plastic check modules, silicone discs, Buna-N seals, and stainless steel springs. Provide strainer ahead.

## 2.3 DOMESTIC WATER SYSTEM VALVES

- A. Balancing Valves: Balancing valve shall be Caleffi 132 series and equipped with an integral flow meter. Valve shall be brass body with brass ball. Flow meter shall be brass body with stainless steel flow meter springs. Flow meter shall have indicator cover and accuracy rated at  $\pm 10\%$ . Provide testing ports upstream and downstream of balancing valve.
- B. Hydrants
  1. WH-1 - Exterior Wall Hydrants: Zurn No. Z1300-CL Series, encased Ecolotrol "anti-siphon" automatic draining wall hydrant for flush installation, Josam, Smith, Wade, or Watts. Complete with non-freeze type integral backflow preventer, bronze casing, all bronze interior parts, non-turning operating rod with free-floating compression closure valve, replaceable bronze seat and seat washer, 3/4" inlet/outlet, and key-operated control valve. Nickel-bronze box and hinged cover with cylinder lock and "WATER" cast on cover. Nickel-bronze cover with polished face. A stainless steel wall hydrant will not be acceptable. Mount wall hydrants with centerline 2'-0" above finished grade.
  2. HB-1 - Hot or Cold Water Hose Bibbs: Chicago Faucet No. 952-1/2 CP-AB, 'Lead Free', polished chrome, with integral vacuum breaker spout, Zurn Z-875L7, or T & S. Rough chrome or plain bronze finish shall be acceptable for equipment rooms. Mount hose bibbs with centerline 36" to 42" above finished floor.
  3. Furnish six (6) spare operating keys for all hydrants to the Owner.
- C. Balancing Stations (BS) consists of a check valve, balancing valve, and 2 thermometers, one at the beginning of the Hot Water loop, the other after the check valve. The Contractor shall balance the various hot water piping systems to maintain no more than 3 degrees temperature differential between all loops. Provide a balancing report for each and every domestic hot water loop balanced, detailing what temperature the system was balanced at, at what locations, and what thermometer readings were at the time of balancing.

- D. Vacuum Breakers: For exposed vacuum breakers, 1/2" size, vacuum breaker shall be T&S Brass B-0929-A, wall-mounted elevated atmospheric vacuum breaker with polished chrome plated brass body. For vacuum breakers, 3/4" to 1" size, vacuum breaker shall be Watts Series LF800M4FR, lead free, pressure anti-siphon vacuum breaker, with built-in relief valve.
- E. Vacuum Relief Valve: Vacuum relief valves shall be installed on domestic hot water tanks as indicated on plans. The vacuum relief valve shall be ANSI Z21.22 rated and CSA certified. The vacuum relief valve shall have an all brass body and include a protective cap. Watts Model N36-M1 or approved equal.
- F. Water Dispensing Valves (WDV) shall be Nibco No. 4464 Series, bronze body, Sioux Chief. Icemaker Valve Boxes: Guy Gray "BIM" Series, stainless steel, Stock No. 88156, Model No. SSIB1, or approved equivalent. Box shall include quarter turn valve with 1/2" sweat connection.
- G. Unions shall be wrought copper, ground joints, and solder ends, Nibco, or approved equivalent.

## 2.4 HOT WATER SYSTEM THERMOSTATIC MIXING VALVES

- A. TMV-1 - Provide Leonard Model TM-920B-LF-DT-IT, 1-1/4" inlets and outlet, 1.0 gpm minimum, 115.0 gpm maximum, 'Lead Free' master mixing valve. Bradley, Lawler, or Symmons, as approved by the Professional, shall also be acceptable.
- B. Provide factory assembled and tested large TYPE TM thermostatic water mixing valve, small TYPE TM valve, DURA-trol solid bi-metal thermostat (directly linked to valve porting to control the intake of hot and cold water and compensate for supply temperature or pressure fluctuations) with Seven (7) Year Limited Warranty, color coded dials, locking temperature regulator handles, adjustable limit stops set for 120°F, integral hot and cold supply checkstops, outlet ball valve shutoffs, inlet piping manifold Factory preassembled and tested, rough bronze finish. Valve to meet ASSE 1016 rating.
  - 1. System shall provide full time standby service should one mixing valve require maintenance and shall be piped according to manufacturer's recommendations.

## 2.5 POINT-OF-USE MIXING VALVES

- A. TMV-2 - Individual thermostatic point-of-use mixing valves shall be provided at each sink, lavatory, bank of fixtures, or other appliance requiring hot water. Mixing valves shall be Leonard Model 270-LF-BRKT-CP. Valve shall be of brass and bronze body construction, 'Lead Free', minimum flow rate, .5 GPM; brass and stainless steel flow control components, vandal-resistant temperature handle adjustment, integral checks/strainers, rough bronze finish, and wall mounting bracket. Mixing valve shall conform to ASSE 1070. Bradley, Lawler, or Symmons, shall also be acceptable. Each valve installed must meet fixtures/equipment's maximum flow rate. Coordinate with fixture/equipment supplier prior to submittal.
  - 1. For Kitchen Areas, set outlet temperatures of mixing valves in accordance with the requirements of the Owner's Kitchen Staff Director, or the Kitchen Consultants.
  - 2. For other locations, set outlet temperatures of mixers as shown or as otherwise directed by the Owner.

3. Furnish and install shutoff valves on inlet and outlet piping of each mixing valve. Refer to the mixing valve schedule and piping schematic shown on the drawings.

## 2.6 STOPS

- A. Each plumbing fixture furnished under this Contract and each piece of special equipment furnished under other contracts or by the Owner shall, unless otherwise shown or specified, be provided with compression stop valves on the water supply piping. On copper or PEX piping, ball valves shall be installed on branch water piping to equipment. Stops shall be finished brass, chrome-plated where exposed and shall be provided with stop control as shown or specified.

## 2.7 RELIEF VALVES

- A. Relief valves shall be ASME, pressure relief type or combination temperature/pressure relief type, as manufactured by Watts, Kunkle, or Apollo. Extend each relief valve outlet to nearest funnel/floor drain or safe waste.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. All valves must be accessible.
- B. Provide a shutoff valve at the base of upfed water risers and at the top of downfed water risers with a minimum 3/4" hose end ball drain valve with vacuum breaker and threaded cap at the base of all water risers.
- C. Each piece of equipment that may have to be removed from the system for repair shall be connected by union or flange and provided with isolation valves.
- D. Provide a shutoff valve on water supply to each exterior wall hydrant, regardless of whether shown or not.
- E. Upon installation, all testable backflow preventers shall be tested under the Plumbing Contract, in accordance with manufacturer's installation standards, or in accordance with local authorities or utility company having jurisdiction over the installations. All testing shall be completed by persons certified in this type of work. All costs, fees, or charges required for testing shall be included in the Contract price.

END OF SECTION 220523

## SECTION 220529 – PLUMBING HANGERS AND SUPPORTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The hangers and supports for the various plumbing and fire protection systems shall be as hereinafter described in this section.
- B. Hangers and supports shall be arranged to distribute the weight of the piping and equipment uniformly on the building structure.

### PART 2 - PRODUCTS

#### 2.1 PIPE HANGERS AND SUPPORTS

- A. All pipe hangers, riser clamps, and supports shall be as manufactured by The Modern Pipe Supports Corp., Anvil International, Inc., Tolco Co., or Erico Corp. The following catalog numbers are taken from The Modern Pipe Supports Corp. Catalog to indicate the type of installation required.
- B. Hangers for steel, iron, or plastic piping shall be The Modern Corp. Government ring type hanger, No. 404, complete with band hanger, Fig. No. 540 malleable iron adjuster and rod, or approved equivalent. Hanger bands shall be flat and suitable for application of insulation over the hanger and pipe.
- C. Hangers for all copper piping shall be The Modern Corp. No. 48, complete with copper-plated band; No. 121 copper-plated, malleable iron adjuster, and rod, for pipe sizes ½" thru 6", or approved equivalent. PVC coated, or epoxy coated hangers will be acceptable. Use The Modern Corp. No. 10, with special PVC coated or padded band, and Fig. No. 540 copper plated, malleable iron adjuster, and rod, for pipe sizes larger than 6".
- D. Insulation shall be installed over band hangers and all openings shall be sealed.
- E. If clevis or loop hanger systems are utilized, insulation shields must be installed to maintain uniform insulation thickness and maintain insulation material characteristics.
- F. Hanger rods installed in conjunction with hangers shall be not less than 3/8" for pipe sizes 1/2" to 2"; 1/2" for pipe sizes 2-1/2" and 3"; 5/8" for pipe sizes 4" and 5"; 3/4" for 6" pipe. Hanger rods shall be larger where recommended by the hanger manufacturer.

- G. Piping 2" and smaller supported on steel joists shall be hung from one joist with beam clamps. Piping over 2" and 3" in diameter shall be suspended from 1-1/4" steel pipe or steel angle, laid-in and hook-bolted to the web members of the joists. Piping 4" and 5" shall be supported from three (3) joists. Piping 6" and over shall be supported from not less than four joists.
- H. Piping along walls shall be supported on substantial wall hangers securely attached to construction by means of inserts or expansion sleeves and bolts. Wall hangers shall be similar to Modern Corp. Fig. No. 284, or approved equivalent.
- I. All expansion shells shall be of the self-drilling types, as manufactured by the Phillips Drill Company, Ramset, Rawlplug, or approved equivalent. Shells shall be hammer installed, special flush or hanger rod types. Shells shall be installed with a drill-hammer. Lead expansion shields or lead wedge type shields will not be permitted.
- J. Vertical runs of exposed uninsulated piping shall be supported from walls with sections of Modern Corp. Chan-All channel-strut and strut clamps, or approved equivalent. For all insulated piping, use strut clamps sized to permit a continuous insulation installation.
  - 1. "Klo-Shure" insulation couplings will be acceptable, as represented by Scott Industrial Systems (Tele No. 412-965-3279).
- K. All supports directly in contact with copper piping shall be copper-plated, PVC coated, or epoxy coated, or equivalent. Ferrous metals shall not be used in contact with copper piping. Hangers for copper tubing 6" and smaller shall be copper-plated, PVC coated, or epoxy coated as herein specified; PVC coated or padded hangers for larger copper piping.
- L. Hangers for pipe and tubing, except for fire protection piping, installed horizontally, shall be spaced, at a maximum, as follows:

#### **COPPER PIPE SUPPORT SPACING**

<b>Pipe Size</b>	<b>Copper, FT</b>
Up to 1-1/2"	6
2" and Larger	8

#### **STEEL PIPE SUPPORT SPACING**

<b>Pipe Size</b>	<b>Drainage Service, FT</b>	<b>Gas Service, FT</b>
1"	7	9
1-1/2"	9	12
2" & 2-1/2"	10	13
3"	12	15
4" & 5"	14	17



6"

17

21

- M. All vertical runs of piping shall be supported at each floor and/or at specified intervals, by means of riser clamps. Copper tubing shall be protected against electrolysis, such as copper plating, PVC coating, or epoxy coating, or approved equivalent. Supports shall be placed at minimum ten (10) foot intervals for vertical pipe, except as otherwise dictated by NFPA recommendations for fire protection piping.
- N. Where concentrated loads of valves, fittings, etc., occur, closer spacing may be necessary. Smaller pipe shall be provided with additional supports to prevent piping from sagging. Hangers must be installed not more than 12" from each change in direction of pipes.
- O. Where cast iron pipe is suspended, a minimum of one (1) hanger shall be provided for each length of pipe at each fitting.
- P. Brass chromium plated pipe shall be supported by suitable cast brass, chromium plated supports. All securing devices shall have all exposed heads, finished chromium plated.
- Q. Pipe hangers and hanger spacing for the fire protection systems shall conform to NFPA recommendations. Hangers for the fire protection system shall be UL Listed, FM approved. Hangers shall be adjustable type pattern.
- R. All pipe runs 3" or larger connected to mechanical equipment in Boiler Room and Chiller Room, shall be mounted with steel spring isolators. The first three pipe hangers in the main lines near the mechanical equipment shall be Mason Industries Type PC3ON, Anvil, Tolco, or Erico. Horizontal runs in all other locations shall be isolated by Mason Industries Type 30N hangers, Anvil, Tolco, or Erico. Floor supported piping shall rest on restrained mounts, Mason Industries Type SLR, Anvil, Tolco, or Erico. The first three (3) hangers or mounts near the mechanical equipment shall have the same static deflection as specified for the mountings under the connected equipment. All other hangers and mounts shall have a minimum static deflection of 3/4".

## 2.2 ROOF BLOCK SUPPORTS

- A. Roof block supports for piping shall be Roof Top Blox system, RTB-01. The support blocks must be designed to eliminate roof penetrations, flashings, or damage to roofing membrane. Support body shall be made of recycled UV-resistant Polypropylene Copolymer. Base platform material shall be 1" thick by 25 psi, type 4 closed cell structural foam to distribute and evenly cushion loads. Block must accept 3/8" and 1/2" threaded rod using side entry nut slots to allow fast top side assembly and piping height adjustments. Securing brackets (SBC-07) and adhesive (ADH-13) shall be used for permanently securing unit into position.
- B. Also, acceptable shall be flexible, closed-cell polyethylene foam, by Erico Pipe Pier Support Systems. Wood blocks shall not be acceptable. Foam blocks shall be standard, Figure 1, Part No. PP50H6, 10-1/2"Lx4"Wx6"H, with chemically bonded 14 gauge solid integral pre-galvanized strut channel; UV resistant, and accommodates expansion and contraction of piping. Load rating – 5 lbs. per linear inch of strut. Confirm exact foam block and pipe load requirements with the equipment supplier prior to ordering. Blocks shall be installed according to manufacturer's recommendations. Block spacing shall conform to industry standards.

Blocking shall conform to the Uniform Mechanical Code ('97) 1312.2 for gas piping. Strut clamps and accessories by Plumbing Contractor. Refer to the drawing details.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. All piping shall be supported from the building construction by the use of fixed or adjustable beam clamps, concrete inserts, lag bolts and lag screws from wood construction, brackets, extension rods, adjustable band ring pipe hangers, or other equipment as dictated by the type of building construction.
- B. The Contractor shall place all hanger and support inserts in concrete. Special studs “shot” into concrete will not be permitted.
- C. Perforated band iron, strap, split ring, wire, chain, or pipe hooks will not be permitted for hangers or supports of pipe.
- D. Piping shall not be supported from any other piping systems, ductwork, conduit, etc. Piping shall only be supported by code approved and manufacturer recommended hanger systems connected directly to the building’s structure.
- E. ALL hanger and support locations shall be coordinated and reviewed with the Architect, Structural, HVAC, Electrical and Fire Protection Engineer Construction Representatives during construction. If any hanger locations or connection methods are unacceptable to any of the professional team (for example – penetrations of pre-cast concrete tees, from piping, uneven spacing or height, etc.), the Contractor shall relocate the support, at his own expense, to an approved location.
- F. Attachments to, and penetrations of new or existing concrete structural tees for hanger connections shall be not be permitted until reviewed and approved by the Architect. The Contractor shall be responsible for the expense of all repairs required as a result of the installation of unauthorized attachments to, or penetrations of new or existing concrete structural tees.
- G. Trapeze type hangers may be used for multiple parallel line installations. The Contractor shall submit sketches for the proposed hangers indicating the type of construction, number and size of piping, and maximum spacing to the Architect for approval. Include metal shielding for insulation to rest thereon to avoid crushing. Insulation must be continuous as specified. Electrolysis at pipe/hanger must be prevented.

#### 3.2 UNACCEPTABLE HANGER AND SUPPORT INSTALLATIONS

- A. It is unacceptable to support any pipe(s) or duct(s) from other pipe(s) or duct(s).
- B. If unistrut is used to support piping, strap hangers are unacceptable since they do not allow for continuous insulation.

- C. It is unacceptable for this Contractor to support his work from the hangers of other trades. All trades must install their own hangers.
- D. Unacceptable hanger and support installations shall be corrected as directed by the Architect/Engineer at no cost to the Owner.

END OF SECTION 220529

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## SECTION 220553 – PLUMBING IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

### PART 2 – PRODUCTS

#### 2.1 EQUIPMENT IDENTIFICATION, VALVE TAGS

- A. Where valves, cleanouts, flow switches, tamper switches, transducers, and similar equipment is located above removable tile ceilings or above access panels, the Contractor shall furnish and install identification labels on the corners of the access panels or removable ceiling tiles. Labels shall be provided with the words "VALVES," "CLEANOUT," "FLOW SWITCHES," "TAMPER SWITCHES", "TRANSDUCERS", and similar wording, so that the equipment may be readily located in the future.
- B. Identification labels shall not exceed 3" in length and 1" in height. Black letters shall be 1/8" high on white background. Labels shall be manufactured of engraved Micarta or Bakelite with pressure-sensitive backing and shall be nonabsorbent, nonporous and colorfast. Adhesive backing shall be chemically compounded to hold tight and fast at wide temperature extremes. Labels shall be as manufactured by Seton Name Plate Company, Brady Co., MSI Services. Labels shall be additionally secured with screws or rivets. Flexible plastic punched tapes will not be acceptable. Labels shall be coordinated with those being installed under other contracts. All piping and equipment, insulated and uninsulated, shall be labeled under this contract.
- C. All major pieces of plumbing and fire protection equipment shall include, at a suitable and accessible observation point on the equipment, a manufacturer's stamped brass or aluminum identification plate, with all pertinent capacity data stamped on the plate. Identification plate shall include all specific data, such as model number, serial number, motor data, horsepower, capacities, sizes, amperes, power consumption, speed, flows, temperatures, working pressures, operating pressures, and similar factors as applicable. In addition, pumps shall include total head in feet and impeller sizes.
- D. The Contractor shall be responsible for furnishing and attaching an identification plate for the above mentioned, major equipment if not provided by the equipment manufacturer.
- E. Equipment marking tags shall be engraved phenolic, 1/16" thick, and four edges banded, black with white lettering. The tag shall be securely mounted to the equipment. Tags shall be as organized per the Equipment Schedules and include "date of installation and project number."
- F. The installations will not be considered acceptable unless identification plates and nameplates are attached.

- G. All piping and equipment insulated and uninsulated, installed throughout this Contract, shall be stenciled with the name of the service and with an arrow indicating the direction of flow. Temperature of hot water systems shall also be included. Pressure of Natural Gas system shall be included. Stenciling in exposed locations in finished areas must be coordinated with the Architect prior to installation.
- H. Snap-around pipe markers shall, in general, shall be located near each branch connection, at each valve, at each change in direction, on each side of walls or floors, and at least every 30' on straight runs of pipe. Markers to be on each and every piping system. On smaller runs of piping, center the designations. Snap-around pipe markers by Seton Nameplate Co. "Set Mark," Brady, MSI Services, may be utilized. Identification and colors shall comply with ANSI A13.1. Snap – around markers shall be suitable for exterior use where utilized.
- I. Where pipes are adjacent to each other, markings shall be neatly piped up. All markings shall be located in such a manner as to be easily legible from the floor. Markings on black pipes shall be white.
  - 1. Markings on fire protection piping in exposed areas, such as equipment rooms and storage rooms, shall be yellow on “all red” piping; in finished areas, fire protection pipe colors shall conform to Architect’s requirements for painting. Wet and dry systems shall have different markings.
- J. All labeling, color-coding, and identifying marks for all new piping and equipment shall match existing building’s identifications patterns. Coordinate all labeling with Owner and Architect prior to start of work.

## 2.2 VALVE DIRECTORY

- A. The Contractor shall prepare a type written valve directory (and required copies) showing the number, location, use and normal position of valves installed under the Contract. Tag each valve controlling mains and branches, but not individual shutoff or local control valves on fixtures and equipment. Valve directory shall be a white print schedule enclosed in metal frame with glass front.
- B. Each valve listed in the directory shall have a corresponding number 1-1/2" diameter brass or aluminum tag attached to the valve by means of a brass or aluminum "S" hook or chain. Numbers and code letters shall be as large as possible for identifying each service. Valve tags for plumbing and fire protection shall have different designations. Natural gas valves shall also be tagged. Numbers and tags shall be coordinated with those being installed under the HVAC Contract. Valve tag numbers shall not be repetitious.
- C. Provide two (2) additional copies of valve schedules in a hardback binder to the Owner.

## 2.3 ELECTRICAL EQUIPMENT LABELS

- A. All electrical equipment and items consisting primarily of electrical components shall bear a label of an independent testing laboratory, such as Underwriters’ Laboratory (UL).

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Valve directory shall be installed at the location designated by the Architect.
- B. Any existing valve directories shall be updated with new information.

END OF SECTION 220553

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## SECTION 220700 – PLUMBING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The plumbing pipe insulation shall be as described in this section.

#### 1.3 CODE COMPLIANCE

- A. All insulation materials and installation procedures shall be in accordance with the minimum requirements of The International Energy Conservation Code.

### PART 2 - PRODUCTS

#### 2.1 INSULATION

- A. Furnish and install insulation for the following piping systems and equipment. All insulation and insulating materials, except as herein specified, shall be as manufactured by Knauf, Owens-Corning Company, or Manville. Insulation adhesives, sealers, cements, mastics, and other similar items, except as herein specified, shall be manufactured by HB Fuller, Mon-Eco, Childers, or Vamasco. Same type insulation materials shall be used consistently throughout the entire installation. Thicknesses shall be 1", except for Electric Water Cooler and Ice Machine Branch Drain Piping, which would be ½".
- B. Materials: All materials shall conform to the following:
  - 1. Piping insulation shall be "heavy density," 1-piece molded fiberglass with factory applied type ASN/SSL "All Service" jacket with self-sealing lap. Average thermal conductivity shall not exceed .25 BTU-in. per square foot per degrees Fahrenheit per hour at a mean temperature of 75 degrees. Thickness shall conform to schedule for pipe size and service as specified herein.
  - 2. Vapor-barrier jacket for the fiberglass system shall be white kraft paper bonded to aluminum foil and reinforced with glass fiber, and pressure sensitive, self-sealing lap adhesive conforming to the physical properties listed in next paragraph.
  - 3. The fiberglass insulating system, including insulation, jacket adhesives, mastics and cements, shall have composite fire and smoke hazard ratings as tested under procedure ASTM E-84, NFPA 255, and UL 723, not exceeding: Flame Spread – 25, Fuel Contributed – 50, Smoke Developed – 50.

4. Fittings for the fiberglass system shall also be 25/50/50 rated as described in the preceding paragraph.
5. All products or their shipping cartons shall have label affixed indicating smoke and flame ratings.

C. Installation: Piping Systems

1. Insulation shall be applied on clean, dry surfaces after pressure testing and approval. All insulation shall be continuous, including through wall and ceiling openings and sleeves. Insulation on piping systems shall be maintained with a continuous unbroken vapor seal. Hangers, supports, anchors, guides and equipment shall be insulated, and vapor sealed to prevent condensation.
2. All covered pipe shall be located a sufficient distance from walls, other pipes, ductwork, and other obstacles to permit the application of the full thickness of insulation specified; and if necessary, extra fittings and pipes shall be used.
3. All fiberglass insulation shall be installed with Bostitch outward clinched staples, one (1) every 3" and four (4) at each butt strap.

D. Fittings: Fiberglass systems operating below 60 degrees F: Fittings, valves, unions, and flanges shall be insulated with a fiberglass blanket, 1 pound per cubic foot density wrapped firmly under compression (minimum 2:1) to a thickness equal to the adjoining insulation, secured with No. 20 gauge galvanized annealed steel wire and given a smoothing coat of "asbestos-free" insulating and finishing cement and a vapor barrier sealer. Roof drain bodies and overflow roof drain bodies shall be insulated with fiberglass same as above.

E. Fiberglass systems Operating Above 60 Degrees F: Fittings, valves, unions, and flanges shall be insulated and finished with "asbestos-free" insulating and finishing cement to a thickness equal to the adjoining pipe insulation.

F. Services: All adhesives used for gluing insulations and insulating jackets shall be vermin and mildew-proof. The use of flour paste is prohibited.

G. Insulated fitting covers, as manufactured by Zeston, Proto, or Speedline will be acceptable for the fiberglass system.

H. Where new piping is connected to existing piping, and the insulation is removed, the piping shall be reinsulated and made continuous with the existing insulation.

2.2 PLENUM-RATED INSULATION

- A. For non-plenum rated material, 3M Fire Barrier Plenum Wrap 5A+, shall be used. Plenum Wrap shall be a non-asbestos, high-temperature fiber blanket thermal insulation encapsulated in a fiberglass-reinforced aluminized foil. Wrap to meet ASTM E84, NFPA 262 (UL 910), UL 1887, and ASTM E 136. Plenum Wrap density shall be nominal 6 pcf and have a nominal 1/2" thickness. The fiber blanket shall have a continuous use limit in excess of 1832 degrees F. Flame Spread Index and Smoke Developed Index of foil encapsulated blank shall be <25 / <50.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. This Contractor shall furnish and install non-conducting covering on the following piping and apparatus installed under this Contract. For performing and completing this work, this Contractor shall employ an Insulation Subcontractor specializing and experienced in commercial covering work, responsible to the Plumbing Contractor.
- B. The following work shall be insulated under the Plumbing Contract:
1. Complete, domestic water distribution systems exposed and concealed. Insulate water piping installed within and around cabinetry and casework. Insulate water meters, backflow preventers, pressure reducing valves, and strainers.
  2. All types of roof drain bodies, and all interior storm piping aboveground, exposed and concealed, vertical and horizontal.
  3. Branch drain piping from water coolers and ice machines, exposed and concealed.
  4. Hot water expansion tanks. Cover expansion tanks, including that furnished by the heater manufacturer, with 1" semi-rigid fiberglass board tank insulation in roll form, faced with a factory applied ASJ vapor retarder, 25/50 rated, conforming to ASTM C-795. Knauf "KwikFlex" insulation acceptable.
  5. Insulate inlets and outlets of trap primers, and outlets of trap primer distribution units. Insulate bottoms of distribution units.
  6. All capped water piping with valves arranged for future extension shall be insulated.
  7. All domestic water connections to existing piping. All insulation, new and existing, shall be continuous and all existing insulation that remains must be joined with new insulation for a continuous system.
- C. Domestic water heating boiler and storage tank shall each be furnished with a factory insulated jacket as specified with that equipment.
- D. Cover exposed insulated piping in Public areas with a .030" thick white PVC jacket, including below counters and fixtures, 25/50 flame/smoke rating, with "heavy duty" fittings, as manufactured by Zeston, Proto, or Speedline,
1. In interior finished areas, other than previous described for Public Room, cover exposed vertical insulated piping of any nature to a minimum point 8'-0" above floor level with a minimum .030" thick PVC jacket, of color(s) selected by the Architect.
- E. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, sensors, switches, and transmitters on insulated pipes, vessels, and equipment.

Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

- F. All exposed hot, cold, and drain piping below fixtures for ADA usage shall be insulated, Zurn, McGuire, or Truebro, vandal-resistant as possible. Include insulation of P-Trap. Refer to Section 224000.
- G. Application of insulation materials to piping and fittings shall be done in strict accordance with the manufacturers' recommendations. Where thickness of insulation is not specified, use applicable thicknesses recommended by the manufacturer for the specific use. Piping and equipment exterior shall be clean and dry and approved tests shall be completed before any insulation is applied.

### 3.2 PLENUM-RATED INSULATION

- A. Where non-plenum rated material is installed on the sanitary, storm, vent, and/or domestic water piping systems, Plenum Wrap must be installed. Where non-plenum rated material is to be insulated, the Plenum Wrap is to be installed on the pipe insulation. All Plenum Wrap installations must be continuous to maintain plenum and fire separation requirements. Refer to HVAC drawings and specifications for areas of plenum areas.

END OF SECTION 220700

## SECTION 221116 – DOMESTIC WATER PIPING

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The domestic hot, cold, and hot water return water piping shall be as hereinafter described in this section.
- B. Refer to Section 220523 for interior water valves.

### PART 2 – PRODUCTS

#### 2.1 DOMESTIC WATER DISTRIBUTION PIPING INSIDE BUILDING

- A. Interior domestic water piping above floor level shall be hard drawn copper tubing, Type "L", in accordance with ASTM B-88, with solder joint type wrought copper fittings. Copper tubing manufactured by Cambridge-Lee, Cerro, Mueller, Summit, or approved equivalent. Fittings by Nibco, Cambridge-Lee, Mueller, or approved equivalent.
- B. All exposed piping and fittings at fixtures shall be polished chrome plated.
- C. The use of any of the above listed materials shall be subject to the acceptability of that material with the prevailing local codes and utility company regulations. All water line installations shall conform with the requirements of the local Water Authority serving the building.

#### 2.2 MECHANICALLY FORMED TEES FOR HARD TEMPER COPPER TUBING

- A. The T-Drill assembly of copper tubing will be acceptable. Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height not less than three (3) times the thickness of the tube wall. The collaring device shall be fully adjustable to insure proper tolerance and complete uniformity of the joint. The joining branch shall be notched and dimpled in a single process so as to set the proper penetration of the branch into the fitting to assure a free flow joint.
- B. All joints shall be brazed by certified contractors only in accordance with the Copper Development Association copper tube handbook using B-Cup Series metal filler metal. The T-Drill System shall conform to ASTM Designation F2014-00.

## 2.3 JOINTS AND CONNECTIONS

- A. Joints in above-floor copper piping shall be assembled with lead-free solder using a non-corrosive flux. All copper tubing and fittings 2" and larger shall be tinned prior to making solder joint. All solder joints on tubing 2-1/2" and larger shall be made with the use of a circular flame torch. To be considered "lead free", solder and flux must not contain more than 0.2% lead.
1. For copper piping 2" and larger, a Type "L" copper grooved mechanical coupling system will be acceptable, Victaulic, Gruvlok, or approved equivalent. Use valves as specified only.
  2. For copper piping 4" and smaller above floor level, the Viega ProPress System of mechanical joint copper tubing assembly will be acceptable, Nibco Press System, or approved equivalent. The ProPress System shall consist of an electro-hydraulic pressure crimping tool, with sets of interchangeable crimping jaws, and ProPress special copper fittings. The fittings shall include an O-sealing ring, and shall require no torches, solders, flux, or special pipe burnishing or preparation. A permanent, watertight seal is made by crimping the fittings. Rated at 200 psi; tested to 600 psi. The systems shall be installed in accordance with manufacturer's installation instructions and governing code requirements. Pipe supports shall be installed so that interior horizontal piping is in uniform alignment.
  3. All screw joint copper pipe shall be made with flake graphite and oil or other approved pipe compound applied to the male threads only and screwed tight with not more than 2 threads on the finished joint exposed, and where pipe and fittings are chrome plated, all threads shall be concealed.
- B. Suitable adapters shall be used when necessary for connection to fittings, valves, or other accessories having threaded ends.

## 2.4 ELECTROLYSIS CONTROL

- A. The installation of copper piping shall be accomplished in such a way as not to touch or come in contact in any way with ferrous metal. Where copper tubing, piping, or fittings are anchored, supported or may come in contact with metal construction, an insulating non-conductor spacer similar to lead, rubber, fiber or plastic shall be installed to assure prevention of electrolysis.
- B. Hangers supporting copper tubing shall be all copper, copper-plated or be large enough to accommodate the insulating pipe covering. Copper tubing piping shall not be (even temporarily) supported or secured to ferrous metal.
- C. Connections between ferrous and copper piping shall be with dielectric fittings, Watts, Wilkins, Clearflow, or approved equivalent.

## 2.5 WATER HAMMER ARRESTORS

- A. Furnish and install at high points on domestic water risers, two (2) stories and above, automatic washers, dishwashing equipment, at kitchen booster heater, quick-closing valves, and where otherwise required, Zurn Z1700, Josam, Smith, Wade, or Watts, factory-made water hammer

arrestors, or approved equivalent, of stainless steel or minimum Type "K" or Type "L" copper. Vertical or horizontal pipe air chambers constructed by the Contractor will not be permitted.

- B. Arrestors shall be certified, constructed, and tested in accordance with the recommendations of the Plumbing and Drainage Institute Standard PDI-WH-201 and shall bear their seal of approval.
- C. Provide shocks associated with solenoid or other quick-closing valves serving heavy equipment, such as laundry machines. Shock shall be controlled by the installation of Zurn Z1712 Accumutrol water hammer arrestors, Josam, Smith, Wade, or Watts. Shocks shall be complete with floating stainless steel spherical piston, bronze surge chamber, valve, and gauge assembly.
- D. Use PVC or stainless steel water hammer arrestors for distilled or deionized water systems.

## 2.6 AUTOMATIC AIR VENTS

- A. Automatic air vents (air eliminators) for hot water systems shall be brass, rated 150 psig, the Spirax-Sarco 13WS, Dole, or Hoffman, installed where shown or required. Provide valve on inlet piping to each air vent.

## 2.7 STRAINERS

- A. Backflow preventers, except for fire protection backflow preventers, shall include strainers ahead, integral or separate.
- B. All other strainers shall be cast bronze, "Y" type, tapped for closure plug; plug by Contractor; 20 mesh, Type 304 stainless steel screen, (3" – 3/64" perforated screen; 4" – 1/8" perforated screen), 200 psi WOG, minimum, the Watts No. 777S or No. S777S, Apollo, Watson McDaniel, or Spirax.

## 2.8 GAUGES / THERMOMETERS

- A. Thermometers shall be non-mercury type, the Weiss Instruments DVU 35 Digital Read-Out, or approved equivalent, Trerice or Ashcroft, mounted on V-shaped aluminum 9" scale with bold black piping and numerals on white background. Range -50 degrees F. to 300 degrees F. Connection assembly shall include swivel nut. Scale size, 2 degrees. Accurate to  $\pm$  one scale division. Brass 3/2" stem. Each thermometer shall be installed in a stainless steel or brass separable socket.
  - 1. Thermometer Test Wells (thermowells) shall be Weksler Model 2SL, Trerice, or Ashcroft.
- B. Pressure gauges for domestic water systems shall be Weiss Instruments DUGY3 Digital Read-Out, or approved equivalent, Trerice, or Ashcroft, 4-1/2" dial, 0 – 1000 psi scale, stainless steel case, and bronze bourdon tube. Gauges of 6" dial type shall be the Weksler BA16, or approved equivalent, aluminum, Style "A", same scale, bottom outlet. Each gauge shall be installed with

a Weksler Type A10, brass, 1/4" N.P.T., "T" handle gauge cock and Weksler No. WG42 brass, 1/4" N.P.T. snubber-filter, or equivalent.

1. Pressure gauges for secondary gas regulating equipment shall be of type as specified with that equipment; refer to Section 221124 and 221300.
2. Pressure gauges for the fire protection system shall be of type as specified with that system; refer to Section 221420.

## PART 3 – EXECUTION

### 3.1 WATER DISTRIBUTION

- A. All piping shall be installed in spaces and adjacent to other surfaces with sufficient clearances to permit air relief of the hot water system. Air venting valves shall be installed at all trapped high points in the hot water piping. Air venting valves shall be as specified.
- B. The water systems included under this Contract, interior and exterior, shall be thoroughly flushed upon completion of the installations. Clean out all strainers.

### 3.2 INSTALLATION OF PIPING AND VALVES

- A. Wrapping threads or caulking screwed connections for tightness is prohibited. No horizontal piping shall be built-in or buried in partitions. No piping shall be erected over any motors, panelboards, switchboards, or other electrical equipment unless specifically indicated on the drawings to serve that area with fire protection. Bending of piping will not be permitted; fittings for change of direction shall be utilized. All vertical piping shall be run plumb. All overhead horizontal piping and vertical piping in finished areas shall be concealed, except as otherwise indicated on the drawings.
- B. Cut pipe accurately to measurements, and ream free of burrs and cutting splatter. Carefully align and grade pipe and work accurately into place. Fittings shall be used for any change in direction. Make adequate provisions for expansion and contraction. Install anchors to prevent pipe movement. Provide for expansion at every building expansion joint.
- C. Protect open pipe ends to prevent trash from being placed in the piping during installation. Clean all dirt and cutting debris from pipes before making the next joint.
- D. Small pipe shall be screwed or soldered as required to produce a tight system with full joints and no leaks. Pipe joints showing seepage and drips shall be dismantled and remade in proper way, as required for a substantial installation.
- E. Copper pipe shall be carefully reamed back to full inside diameter and the mating surfaces shall be cleaned by brush or sandpaper. When clean, the paste flux shall be applied and the joint evenly heated and soldered. Any fittings discolored by heat shall be removed and replaced.
- F. All valves to be soldered into piping shall be dismantled to prevent the heat from destroying packing and seats.



- G. Valves installed in threaded or flanged piping shall be properly supported and pipes carefully installed to prevent damage or distortion of the valve.
- H. Grooved pipe shall be carefully prepared, and all burrs removed inside and outside the pipe. The proper lubricant shall be applied, and the gasket carefully placed prior to tightening the clamps to the correct torque.
- I. Install minimum  $\frac{3}{4}$ " ball valve drains with vacuum breakers and threaded caps at every low place and air vents at every high place. Pipe shall slope as shown on the Drawings or in the Specifications. If slope is not shown or specified, slope in the direction of flow one (1") inch per every forty (40') feet.
- J. Install pressure gauges, thermowells, and thermometers as specified or shown in details on the Drawings.
- K. All valves must be accessible.
- L. Extend each air vent outlet and relief valve outlet full size to nearest funnel/floor drain or safe waste.

### 3.3 CLEANING AND TREATING OF PIPE SYSTEMS

- A. Every pipe system shall be cleaned to remove trash, mill scale, cutting oil, welding, and burning splatter from the piping before any control devices are installed. If such debris has collected in valves, the valves shall be disassembled and cleaned prior to closing for the first time.
- B. Brush and clean work prior to concealing, painting, and acceptance. Perform in stages if directed by the Architect.
- C. Clean and repair painted exposed work, soiled or damaged, to match adjoining work before final acceptance.
- D. After several hours of operation, each strainer shall be blown down. This shall be repeated as often as necessary to produce a clean discharge from the blowdown. Prior to turning the system over to the Owner, each strainer shall be cleaned, removed if necessary for this requirement.

### 3.4 INSTALLATION AND TESTING PROCEDURES

- A. All domestic water distribution piping included under this Contract shall be hydrostatically tested to a pressure of one and one-half times the normal system pressure or 150 psi, whichever is greater, and maintained for a period of 2 hours with a pressure loss of not more than 5 psi. The exterior water distribution system included under this Contract shall be installed and tested in compliance with the local Water Authority. Confirm requirements prior to bidding.

### 3.5 DISINFECTION OF WATER SYSTEM

- A. Before being placed in service, all water piping, interior and exterior, included under this Contract, shall be chlorinated to the satisfaction of the Architect.
- B. Prior to chlorination, all dirt, foreign matter shall be removed by a thorough flushing.
- C. A water mixture of hypochlorite solution shall be applied by means of a solution-feed device.
- D. Treated water shall be retained in the pipe long enough to destroy all non-spore forming bacteria. This period shall be at least 3 hours and preferably longer as may be directed.
- E. After the chlorine treated water has been retained for the required time, the chlorine residual at the pipe extremities and at other representative points shall be at least 5 parts million.
- F. Following chlorination, all treated water shall be thoroughly flushed from the newly installed piping at its extremities until the replacement water throughout its length shall, upon test, be equal to the water quality served from the municipal water supply system.
- G. Should the initial treatment, in the opinion of the Architect, prove ineffective, the chlorination procedure shall be repeated until confirmed tests show the water sampled from the newly installed piping conforms to the requirements.

### 3.6 EXPANSION COMPENSATION

- A. Pipe installations shall allow for expansion due to temperature differences. Provide expansion offsets in piping where necessary to control expansion.
- B. Provide for expansion at every building expansion joint.
- C. Separate expansion joints shall be a braided bronze or stainless steel flexible pipe connector, as manufactured by Flex-Hose Co., Inc., Flexonics, or Flexible Metal, Inc., suitable for water service. Expansion joints must be accessible.

### 3.7 BRANCH PIPING TO FIXTURES AND EQUIPMENT

- A. Branch piping shall be extended and connected to all fixtures and equipment requiring same. Sizes of such connections shall be as indicated on the drawings and the Fixture Schedule, or as required by the particular piece of equipment or fixture being served. If the sizes of such connections are not clearly indicated, the Contractor shall verify the sizes required with the Architect prior to commencement of any roughing-in work. Changes to piping necessitated due to the Contractors' failure to properly verify the required sizes shall be made at the Contractors' expense.

### 3.8 WATER MAKE-UP SYSTEMS

- A. Every water system not used for domestic water, such as for HVAC equipment and similar equipment, shall be provided with an RPZ backflow preventer, certified for that service and acceptable to the local plumbing code administrator to prevent back pressure or back siphonage of contaminated water into the domestic water system.

END OF SECTION 221116

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## SECTION 221124 – NATURAL GAS PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE OF WORK

- A. The interior natural gas distribution systems shall be described in this section. All work shall conform to the National Fuel Gas Code, NFPA Standard 54.
- B. All work under this Contract shall conform to the requirements and regulations of the Gas Company serving the building.

### PART 2 - PRODUCTS

#### 2.1 NATURAL GAS PIPING

- A. Gas piping 2" and larger above ground shall be Schedule 40 ASTM A-106 seamless black steel pipe, Schedule 40 ASTM A-53 black steel pipe acceptable.
- B. Gas piping 1-1/2" and smaller above ground shall be Schedule 40 ASTM A-53 black steel pipe.
- C. Galvanized pipe and fittings not acceptable.
- D. Gas piping shall be sloped not less than 1/4" in 15 feet to prevent traps.
- E. Exterior gas sediment traps shall be required for all exterior gas-fired equipment on 'dry gas' systems and shall be installed per NFPA recommendations.
- F. Provide gas drips legs as required per Gas Company requirements on 'wet gas' systems. Exterior gas drip legs not permitted per the National Fuel Gas Code; install gas legs at heated interior of building to avoid condensate freeze-up, in accordance with interpretation NFPA recommendations, or as otherwise directed by the Gas Company.

#### 2.2 VALVES

- A. Furnish and install all valves necessary to the proper operation of the system. A valve shall be placed where each branch leaves the main and at such points as required for the proper control and shut-off of all piping. Each piece of equipment that may have to be removed from the system for repair shall be connected by union or flange and provided with isolation valves. Gas valves shall be of manufacturer and style as listed on the Gas Company approved materials list, as manufactured by Homestead, Nibco, Apollo, or Crane.
- B. Furnish and install full port gas valves for the gas supply piping to all gas-fired equipment. Furnish and install main full port gas valves, sized to match the incoming gas main into the building. Restricted port gas valves will not be acceptable.

## 2.3 GAS REGULATORS

- A. Furnish and install interior gas regulators where shown, complete with pressure gauges, unions, and gas shut-off valves on inlet and outlet. Regulator shall be as manufactured by Maxitrol, Chaplin-Fulton, or Fisher, of type conforming to Gas Company requirements. Coordinate with manufacturer regarding specific sizing. Regulator shall conform to ANSI Standard Z21.80. Regulator must provide positive tight shutoff, or positive tight lock-up at zero flow. Provide documentation of BTU and pressure range at FULL LOAD on submittal.
  - 1. Pressure gauges shall be 2-1/2" minimum diameter, with waterproof cases, the Weksler No. 25KL, Terice, or Ashcroft. Pressure gauges shall include brass socket, plastic lens, phosphor bronze diaphragm, required pressure range, 1/4" N.P.T., suitable for reading natural gas.
- B. Regulators located inside the building must be vented to the outside. The vent pipe shall be at least the same size as the relief vent outlet and shall be designed to prevent the entry of water, insects or other foreign material. (The only exception is that a regulator containing a vent limiter that is listed as complying with ANSI Z2.18 may be installed inside, in a well ventilated location, without a vent to the outside).
  - 1. For exterior regulators, pressure gauges shall include waterproof cases.

## PART 3 - EXECUTION

### 3.1 JOINING NATURAL GAS PIPING

- A. Gas piping, 2" and smaller, shall be installed by threaded pipe and fittings. Welded piping, 2-1/2" and larger, shall be welded with appropriate fittings and procedures. Welding shall be performed by certified welders only. Threaded fittings shall be assembled with 150 lb. malleable iron screwed fittings. All gas pipe fitting installations MUST adhere to NFPA 54 requirements.
  - 1. Where screw fittings are utilized, field threading shall meet the requirements of ANSI B2.1. Screw joints shall be made up tight using a non-hardening pipe joint compound applied to male threads only.

- B. When installing piping which is to be concealed, the number of fittings shall be kept to a minimum.
- C. Separate expansion joints shall be a braided bronze or stainless steel flexible pipe connector, as manufactured by Flex-Hose Co., Inc., Flexonics, or Flexible Metal, Inc., suitable for gas service, conforming to Gas Company requirements. Expansion joints must be accessible.

### 3.2 DEFECTIVE NATURAL GAS PIPING

- A. When defective pipe or fittings are located in the system, the defective material shall be replaced. Under no circumstances shall defects in pipe or fittings be repaired.

### 3.3 PURGING NATURAL GAS

- A. Prior to establishing service, all gas piping shall be fully purged. Piping shall not be purged into the combustion chamber of an appliance.
- B. The open end of piping systems being purged shall not discharge into confined spaces or areas where there are sources of ignition unless precautions are taken to perform this operation in a safe manner, by ventilation of the space, control of purging rate, and elimination of all hazardous conditions. Never leave the appliance while purging.

### 3.4 TESTING AND INSTALLATION REQUIREMENTS – NATURAL GAS

- A. The gas piping included under this Contract shall be given a pressure test with air or an inert gas before being placed in service, in accordance with Gas Company requirements. Under no circumstances may oxygen, flammable gas or any liquid be used as the test medium. To locate leaks, piping joints should be covered with soapsuds or a leak-finder liquid. In no case shall ether, Freon, or any gas that will produce a toxic atmosphere when burned, be injected into the piping to locate leaks.
- B. Gas piping, as shown by testing, must be free of leaks before being placed in service. All testing shall be done using an approved gauge.
- C. All gas piping included under this Contract shall be installed and tested in strict accordance with requirements of the Gas Company. The Contractor shall contact the Gas Company before bidding for service and shall obtain and pay all fees required for work included under this Contract. All fees required by the Gas Company must be included.

### 3.5 NATURAL GAS COLOR CODING/LABELING

- A. Color code, and/or label interior and exterior exposed and accessible concealed gas piping, included under this Contract, per Gas Company and Owner requirements.

### 3.6 ROOF GAS PIPE FLASHING

- A. Roof gas pipe flashing will be included under this Contract.

END OF SECTION 221124



## SECTION 221316 – SANITARY WASTE AND VENT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The sanitary waste and vent piping systems shall be as hereinafter described in this section. Make all required connections into the interior sanitary drainage systems.

#### 1.3 CODE COMPLIANCE

- A. All sanitary materials and installation methods shall be subject to the acceptability of that material with the prevailing local plumbing codes.

#### 1.4 PIPE AND MATERIALS

- A. This Contractor shall furnish and install sanitary sewer and vent piping as indicated on the Drawings. Pipe sizes indicated are minimum sizes. Minimum size below bottom floor or below ground, interior, 4". Pipe sizes shall be larger where required by local codes.
- B. Cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

### PART 2 – PRODUCTS

#### 2.1 SANITARY SEWER AND VENT PIPING UNDERGROUND,

- A. Polyvinyl Chloride (PVC) Plastic Pipe Schedule 40 DWV ASTM 2665 solvent weld. PVC foam core piping and fittings not permitted. PVC pipe and fittings as manufactured by Charlotte, Geneva, Spears, or approved equivalent.
  - 1. SDR-35 PVC piping and fittings will be acceptable for larger interior piping underground where solvent welded Schedule 40 PVC piping and fittings cannot be obtained in those sizes.

#### 2.2 SANITARY SOIL, WASTE, AND VENT PIPING ABOVE GROUND

- A. Polyvinyl Chloride (PVC) Schedule 40 Plastic Pipe (DWV) ASTM 2665 solvent weld. PVC foam core piping and fittings not permitted. PVC pipe and fittings as manufactured by Charlotte, Geneva, Spears, or approved equivalent.
- B. Use for plenum areas and other required locations, piping shall be coated Cast Iron Hubless pipe and fittings and shall conform to ASTM A-888, CISPI 301. Pipe and fittings as manufactured by Charlotte, Tyler, or AB & I.
  - 1. Extra heavy weight coated cast iron hub and spigot soil pipe and fittings, ASTM A74, shall be utilized where required by local codes
- C. Automatic air vent or relief valve discharge piping shall be Type "L" copper with drainage pattern fittings. Plastic piping and fittings will not be permitted for this installation.
- D. Vent piping to atmosphere shall be minimum 3" diameter and terminate a minimum of 12" above roof level. Terminate vent piping at a higher height above roof level where required by local codes. Rigidly support all vent piping extending through roof.
- E. For above ground drainage piping changes in direction, use long sweep fittings where possible; otherwise, short-sweep 1/4 bends, or combination Y and 1/8 bends, also Y's or in combination with other bends; use 45 degree Y or 90 degree Y short turn type for horizontal branches discharging to stacks; however, approval must be obtained for these locations.
- F. Where new vent piping is internally connected to existing vent piping which extends through roof, verify height of that existing vent pipe above roof and modify same as necessary to conform with local code and local Plumbing Inspector requirements for correct vent pipe height above roof.

## 2.3 JOINTS AND CONNECTIONS

- A. Joints for Hubless Cast Iron Pipe and Fittings Above Grade
  - 1. Couplings for joining hubless cast iron soil pipe and fittings conforming to ASTM A-888, shall be 3 inches wide for nominal pipe sizes 1 1/2 to 4 inches in diameter, 4 inches wide for nominal pipe sizes 5 to 10 inches in diameter, and 5 5/8 inches wide for couplings 12 and 15 inches in diameter. Shields shall have a minimum thickness of .015 inches, (28 gage) type 304 stainless steel. Worm drive clamps shall be type 304 stainless steel with a minimum clamp torque of 80 in/lbs. Sealing Gasket shall be neoprene conforming to ASTM C-564. Couplings shall conform to Factory Mutual Standard 1680, Class 1, or ASTM C-1540, as manufactured by Clamp-All Products Models HI-TORQ 80 and HI-TORQ; or Huskey Technologies Model SD-4000.
    - a. Alternative to above, cast iron split clamps secured by stainless steel bolts and nuts with neoprene gasket conforming to ASTM C-564; as manufactured by MG Coupling Company.
    - b. Factory Mutual Approved Couplings may be hung with one (1) hanger per length of pipe for 10 foot lengths and at every third fitting where they are contiguous in conformance with manufacturers installation instructions.

- B. Joints in PVC pipe shall be accomplished with socket type fittings and solvent-cement welding for the interior DWV System, above floor or below bottom floor.
- C. All transition joints in sewers between dissimilar materials or unequal sizes shall be made water and gas tight by means of an approved connection or adapter of the compression or mechanical seal type. The connector or adapter shall be manufactured of preformed Elastomeric Polyvinyl Chloride conforming to ASTM Standards C-425, C-594, C-564, and D-1869. Couplings of the mechanical seal type shall have tightening clamps or devices made of 305 stainless steel. The compression joint connector or adapter and flexible coupling shall be installed as recommended and specified by the manufacturer and each connector shall bear the manufacturer's name clearly visible when installed, such as manufactured by Fernco Joint Sealer Company, Indiana Seal, or Mission.
- D. All joints shall be made permanently gas and water tight.
- E. The use of any of the above joints and connections shall be subject to their acceptability with the prevailing local plumbing codes.

## 2.4 FLOOR DRAINS

- A. The Contractor shall furnish and install the following types of floor drains, by Zurn, Josam, Smith, Mifab, Wade, or Watts. Refer to "Tamperproof Screws", Section 220500. All drains shall have 1/2" trap primer connections as shown on the drawings. Plug any unused primer connections.
  - 1. FD-1 – Zurn ZN415-BZ-P-VP Series, bottom outlet, coated cast iron body with polished nickel-bronze leveling strainer, ZN400BZ-VP, Type BZ, vandal-proof, or approved equivalent. Strainers in shower rooms and locker rooms shall be 8" size. All other strainers shall be 6" size. (Finished Areas)
- B. All floor drains in floor construction shall be set over P-traps, except exterior drains and shall be furnished and installed with flashing flanges and clamping collars.
  - 1. P-traps with trap primer connections will be acceptable in lieu of floor drains with primer connections.
- C. The Contractor shall check with the Local Plumbing Inspector for setting of tops of all floor sinks and funnel/floor drains relative to finish floors.
- D. The Contractor shall coordinate with finished flooring materials to confirm if any additional accessories, including clamping, bracing, etc., for all drains prior to submittal shall be required.

## 2.5 CLEANOUTS

- A. The Contractor shall furnish and install cleanouts at each change in direction greater than 45° in sanitary drainage systems, at the base of all sanitary drainage stacks, and at all other points indicated on the Drawings.

- B. Cleanouts installed on under-floor piping, exterior piping, or piping below slab on grade floors shall be extended to floor level or grade level with 45 degree fittings.
- C. Cleanouts on concealed piping shall be extended so as to be easily accessible from finish floor, ceiling, or wall.
- D. Cleanouts shall be full pipe size up to and including 4", and shall be 4" on larger size piping, if approved by the local authorities having jurisdiction over the installations.
- E. All cleanout equipment shall be Zurn, Josam, Smith, Mifab, Wade, or Watts. Refer to "Tamperproof Screws", Section 220500.
  - 1. Zurn ZN1443-VP / ZN1447-VP – Cleanout with nickel-bronze access cover with vandal-proof screws, for all piping concealed. For all locations other than where access panels or doors are noted. Plastic, PVC, or fiberglass type cleanout covers not acceptable.
  - 2. Zurn ZN1400-VP – Adjustable floor cleanout with round top, vandal-proof screws. Zurn ZN1400-X-VP – for vinyl tile; ZN1400-Z-VP – for 1-1/4" terrazzo, vandal-proof screws; ZN1400-CM-VP – for carpet installation, vandal-proof screws.
- F. For cleanouts on PVC piping above floor level, cleanouts shall be PVC threaded plugs in wye fittings. For cleanouts on cast iron piping above floor level as described herein, cleanouts shall be cast bronze threaded plugs in wye fittings.
- G. Floor cleanouts in interior heavy duty traffic areas, shops, equipment rooms, boiler rooms, janitor's closets, and storage rooms shall be cast bronze flush floor plugs, Zurn ZARB-1470-PW, or approved equivalent. Provide two (2) plug wrenches only, total.
- H. Floor cleanouts shall be furnished and installed with flashing flanges and clamping collars. Floor cleanouts on the bottom-most slab shall not require flashing.
- I. Where vertical piping is installed in chases in finished rooms, extension pieces, if required, shall be placed in tees so as to bring cleanout plugs to the back of the cover plate set flush in the finished walls.
- J. Except where cover plates are provided with a recess for inserts of the same material as the floor finish, all cover plates in floors of finished areas shall be scoriated nickel bronze. Frames for the cover plates shall be compatible with the finished flooring material.
- K. Care shall be exercised in installing cleanouts to avoid locating them in surfaces to be carpeted. Provide additional piping as required to locate cleanouts in other more accessible surfaces.
- L. The Contractor shall lubricate all plugs before installation and shall loosen all covers and plugs before final inspection as directed by the Architect.

## 2.6 TRAPS

- A. Service weight or extra heavy weight cast iron, or PVC, shall be used in accordance with applied piping system.

- B. A separate trap shall be provided for each plumbing fixture which does not contain an integral trap. In general, all fixture traps shall be provided with accessible cleanout plugs located on the bottom of the bend.
- C. Traps shall be set true with respect to their water seals.

## 2.7 TRAP PRIMERS

- A. Standard type trap primer shall be the Zurn No. Z1022-XL, Josam, Smith, PPP, Mifab, Wade, or Watts, plain bronze body, automatic, 1/2" in/out, with integral vacuum breaker, non-liming internal operating assembly, with gasketed bronze cover. Provide trap primer piping to all floor drains, regardless if piping shown or not on drawings. Valve the inlets to the trap primers. Refer to the drawing details.
  - 1. Provide trap primer distribution units where more than one floor drain is primed, Zurn DU Series, Precision Plumbing Products, Inc., or Sioux Chief, with supply tubes.
- B. Provide trap primers for all interior drains shown on the plans, regardless if shown on the drawings or not.

## PART 3 – EXECUTION

### 3.1 GRADE

- A. Elevations and locations of floor drains, funnel drains, floor sinks, and cleanouts shall be adjusted to avoid interference with other utilities and equipment without additional expense.

### 3.2 FLASHING

- A. Provide 48" square sheet lead, copper, or neoprene flashing for floor drains, funnel drains, floor sinks, and cleanouts, set integral with floor slab. Chloroloy, or approved equivalent non-plasticized chlorinated polyethylene waterproofing membrane will be acceptable for flashing of floor drains, funnel drains, floor sinks, and cleanouts.
- B. Vents through new roof construction will be flashed by the General Contractor. Openings, patching, restoring, and flashing in existing roof by Roofing Contractor at Plumbing Contractor's expense.

### 3.3 INSTALLATION AND TESTING PROCEDURES

- A. Horizontal cast iron pipe and fitting installations above ground, 6" and larger, shall be suitably braced to prevent horizontal movements, at every branch opening or change of direction, by the use of braces, blocks, rodding, or other suitable method, in accordance with pipe manufacturer's and Cast Iron Soil Pipe Institute's installation instructions. Vertical cast iron pipe and fitting installations above ground of all sizes shall be secured at each stack base and at

sufficiently close intervals to keep the system in alignment and to adequately support the weight of the pipe and its contents.

- B. Unless noted otherwise on the Drawings or herein specified, or required to suit final floor elevations, all sanitary piping 3" and larger shall be installed with a uniform minimum slope of 1/8" to the foot and all sanitary piping 2" and smaller shall be installed with a uniform minimum slope of 1/4" to the foot, or as otherwise required by local codes.

- 1. Maintain 30" minimum ground cover over top of exterior sewers.

- C. Interior sanitary drainage piping shall be hydrostatically tested after completion of the roughing-in. Piping being tested shall be filled to the top of vent pipes, and left standing for a period of one (1) hour with no loss of water. Smoke tests will be acceptable if required by local authorities. Confirm requirements prior to bidding.
- D. After testing and before final acceptance, the Contractor shall completely flush the entire sewer systems and appurtenances included under this Contract in sufficient volume to remove all settlement and debris to obtain free flow through each pipe. Flushing shall be accomplished by the use of automatic flush tanks, fire hoses, or other means approved by the Architect. Depths of water and velocities shall be as required to produce a hydraulic bore. Remove all obstructions and correct all defects discovered.
- E. Exercise extreme care to prevent debris from entering floor drains or cleanouts. Carefully check invert elevations of floor drains to which connections are to be made.

### 3.4 CLEANING AND FLUSHING OF EXISTING SANITARY SEWERS

- A. The Contractor shall clean and flush out existing interior sanitary sewers inside the building effected by this project, by the hydro-sewer cleaning method, using high pressure water.
- B. The Contractor shall clean the designated sanitary sewers of all debris, grease, sand, sludge, soap, rocks, and accumulations, flush out, and ensure that all such sewers are completely free-flowing.
- C. All sanitary sewer cleaning and flushing work shall be completed by the hydro-cleaning process, by a competent independent firm, with workers specifically skilled in this type of work.
- D. A written report of the cleaning and flushing work, and remaining condition of these existing sanitary sewers, shall be included. A copy of each shall be furnished to the Owner and the Architect.
- E. All fees, charges, and costs for cleaning and flushing work shall be included under the Plumbing Contract.

### 3.5 THERMAL EXPANSION AND CONTRACTION – PVC PIPE

- A. Highly important is the change of PVC pipe with temperature variations. This fact shall always be considered when installing PVC pipe piping, and allowances made accordingly.

- B. Compensate for PVC piping thermal expansion and contraction in accordance with PVC manufacturer's instructions and local code requirements. Utilize the following, but not limited to: offsets, loops, additional bends, piston type expansion joints with "O" ring design, and axial guides. Expansion joints must be accessible.

### 3.6 FINAL INSPECTION

- A. At the time of final inspection of the work performed under the Contract, the floor drains and cleanouts shall be complete in every respect and in perfect operating condition. All surplus materials of every description resulting from the work shall have been removed. Floor drains shall be free from debris, sand, silt or other obstructions. Any defects discovered in the floor drains, floor sinks, funnel drains, and cleanouts subsequent to this inspection shall have been corrected.

END OF SECTION 221316

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## SECTION 221413 – STORM DRAINAGE PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The storm drainage piping systems shall be as hereinafter described in this section. Make all required connections into the interior storm drainage systems.

#### 1.3 CODE COMPLIANCE

- A. All storm drainage pipe materials and installation methods shall be subject to the acceptability of that material with the prevailing local plumbing codes.

#### 1.4 PIPE AND MATERIALS – GENERAL

- A. This Contractor shall furnish and install storm sewer piping as indicated on the Drawings. Minimum size below bottom floor or below ground, interior, 4". Pipe sizes shall be larger where required by local codes.
- B. Cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

### PART 2 – PRODUCTS

#### 2.1 STORM SEWER PIPING BURIED UNDERGROUND

- A. Polyvinyl Chloride (PVC) Plastic Pipe Schedule 40 DWV ASTM 2665 solvent weld. PVC foam core piping and fittings not permitted. PVC pipe and fittings as manufactured by Charlotte, Geneva, Spears, or approved equivalent.
  - 1. SDR-35 PVC piping and fittings will be acceptable for larger interior piping underground where solvent welded Schedule 40 PVC piping and fittings cannot be obtained in those sizes.
- B. Provide storm sewers exiting the building each with vents, house traps, and cleanouts within the limits of sewer construction included under this Contract work, as required by the prevailing plumbing code and /or the sewer authority having jurisdiction.

1. For storm mains that exit the building below structural components, piping shall be sleeved and encased in concrete a minimum of 2'-0" beyond of the structural component, on either side. Coordinate specific requirements with structural design prior to installation.
2. For storm mains that exit the building through structural components, piping shall be sleeved through the component. Installation, location, and depth of sleeves need to be strictly coordinated with General Contractor prior to installation.

## 2.2 STORM DRAINAGE PIPING ABOVE GROUND

- A. Polyvinyl Chloride (PVC) Schedule 40 Plastic Pipe (DWV) ASTM 2665. PVC foam core piping and fittings not permitted. PVC pipe and fittings as manufactured by Charlotte, Geneva, Spears, or approved equivalent.
- B. Use for plenum areas and other required locations, piping shall be coated Cast Iron Hubless pipe and fittings and shall conform to ASTM A-888, CISPI 301. Pipe and fittings as manufactured by Charlotte, Tyler, AB & I, or approved equivalent.
- C. For above ground drainage piping changes in direction, use long sweep fittings where possible; otherwise, short-sweep 1/4 bends, or combination Y and 1/8 bends, also Y's or in combination with other bends; use 45 degree Y or 90 degree Y short turn type for horizontal branches discharging to stacks; however, approval must be obtained for these locations.

## 2.3 PRIMARY AND SECONDARY ROOF DRAINS

- A. The Contractor shall furnish and install the following types of roof drains and overflow roof drains, by Zurn, Josam, Smith, Mifab, Wade, or Watts.
  1. Primary Roof Drain (RD-1) – Zurn No. ZA100-ERC Series, coated cast iron body with under-deck clamp, static extension, roof sump receiver, integral membrane flashing clamp/gravel guard and 6-3/4" high aluminum dome, or approved equivalent. Size as indicated on the Drawings. Coordinate exact components with roof construction. Adjustable Dura-Coated extension assembly (EA suffix) will be acceptable. If the Contractor so desires, the No. ZA100-E-DP "Top-Set" roof drain with roof deck plate, or approved equivalent, will be acceptable. Adjustable Dura-Coated drain riser extension assembly (DR suffix) will be acceptable.

## 2.4 JOINTS AND CONNECTIONS

- A. Joints for Hubless Cast Iron Pipe and Fittings Above Grade
  1. Couplings for joining hubless cast iron soil pipe and fittings conforming to ASTM A-888, shall be 3 inches wide for nominal pipe sizes 1 1/2 to 4 inches in diameter, 4 inches wide for nominal pipe sizes 5 to 10 inches in diameter, and 5 5/8 inches wide for couplings 12 and 15 inches in diameter. Shields shall have a minimum thickness of .015 inches, (28 gage) type 304 stainless steel. Worm drive clamps shall be type 304 stainless steel with a minimum clamp torque of 80 in/lbs. Sealing Gasket shall be neoprene conforming to ASTM C-564. Couplings shall conform to Factory Mutual Standard 1680, Class 1, or

ASTM C-1540, as manufactured by Clamp-All Products Models HI-TORQ 125 and HI-TORQ; or Huskey Technologies Model SD-4000.

- a. Alternative to above, cast iron split clamps secured by stainless steel bolts and nuts with neoprene gasket conforming to ASTM C-564; as manufactured by MG Coupling Company.
  - b. Factory Mutual Approved Couplings may be hung with one hanger per length of pipe for 10 foot lengths and at every third fitting where they are contiguous in conformance with manufacturers installation instructions.
- B. Joints in PVC pipe shall be accomplished with socket type fittings and solvent-cement welding for the interior DWV System, above floor or below bottom floor.
- C. Connections from Roof Drains to associated storm piping shall use Husky Series 2000 stainless steel coupling, with four (4) stainless steel clamps. Gasket shall be manufactured from a properly vulcanized virgin compound in which the primary elastomer is polychloroprene conforming to ASTM C-564.
- D. All transition joints in sewers between dissimilar materials or unequal sizes shall be made water and gas tight by means of an approved connection or adapter of the compression or mechanical seal type. The connector or adapter shall be manufactured of preformed Elastomeric Polyvinyl Chloride conforming to ASTM Standards C-425, C-594, C-564, and D-1869. Couplings of the mechanical seal type shall have tightening clamps or devices made of 305 stainless steel. The compression joint connector or adapter and flexible coupling shall be installed as recommended and specified by the manufacturer and each connector shall bear the manufacturer's name clearly visible when installed, such as manufactured by Fernco Joint Sealer Company, Indiana Seal, or Mission.
- E. All joints shall be made permanently gas and water tight.
- F. The use of any of the above joints and connections shall be subject to their acceptability with the prevailing local plumbing codes.

## 2.5 CLEANOUTS

- A. The Contractor shall furnish and install cleanouts at each change in direction greater than 45° in sanitary drainage systems, at the base of all sanitary drainage stacks, and at all other points indicated on the Drawings.
- B. Cleanouts installed on under-floor piping, exterior piping, or piping below slab on grade floors shall be extended to floor level or grade level with 45 degree fittings.
- C. Cleanouts on concealed piping shall be extended so as to be easily accessible from finish floor, ceiling, or wall.
- D. Cleanouts shall be full pipe size up to and including 4", and shall be 4" on larger size piping, if approved by the local authorities having jurisdiction over the installations.
- E. All cleanout equipment shall be Zurn, Josam, Smith, Wade, or Watts. Refer to "Tamperproof Screws", Section 220500.

1. Zurn ZN1443-VP / ZN1447-VP – Cleanout with nickel-bronze access cover with vandal-proof screws, for all piping concealed. For all locations other than where access panels or doors are noted. Plastic, PVC, or fiberglass type cleanout covers not acceptable.
  2. Zurn ZN1400-VP – Adjustable floor cleanout with round top, vandal-proof screws. Zurn ZN1400-X-VP – for vinyl tile; ZN1400-Z-VP – for 1-1/4” terrazzo, vandal-proof screws; ZN1400-CM-VP – for carpet installation, vandal-proof screws.
- F. For cleanouts on PVC piping above floor level, cleanouts shall be PVC threaded plugs in wye fittings. For cleanouts on cast iron piping above floor level as described herein, cleanouts shall be cast bronze threaded plugs in wye fittings.
- G. Floor cleanouts in interior, heavy duty traffic areas, shops, equipment rooms, and janitor’s closets, and storage rooms shall be cast bronze flush floor plugs, Zurn ZARB-1470-PW, or approved equivalent. Provide two (2) plug wrenches only, total.
- H. Floor cleanouts shall be furnished and installed with flashing flanges and clamping collars. Floor cleanouts on the bottom-most slab shall not require flashing.
- I. Where vertical piping is installed in chases in finished rooms, extension pieces, if required, shall be placed in tees so as to bring cleanout plugs to the back of the cover plate set flush in the finished walls.
- J. Except where cover plates are provided with a recess for inserts of the same material as the floor finish, all cover plates in floors of finished areas shall be scoriated nickel bronze. Frames for the cover plates shall be compatible with the finished flooring material.
- K. Care shall be exercised in installing cleanouts to avoid locating them in surfaces to be carpeted. Provide additional piping as required to locate cleanouts in other more accessible surfaces.
- L. The Contractor shall lubricate all plugs before installation and shall loosen all covers and plugs before final inspection as directed by the Architect.

### PART 3 – EXECUTION

#### 3.1 GRADE

- A. Elevations and locations of primary roof drains, overflow roof drains, and cleanouts shall be adjusted to avoid interference with other utilities and equipment without additional expense.

#### 3.2 FLASHING

- A. Provide 48” square sheet lead, copper, or neoprene flashing for cleanouts, set integral with floor slab. Chloroloy, or approved equivalent non-plasticized chlorinated polyethylene waterproofing membrane will be acceptable for flashing of cleanouts.
- B. Roof drains in roof will be flashed by the General Contractor.

### 3.3 INSTALLATION AND TESTING PROCEDURES

- A. Horizontal cast iron pipe and fitting installations above ground, 6" and larger, shall be suitably braced to prevent horizontal movements, at every branch opening or change of direction, by the use of braces, blocks, rodding, or other suitable method, in accordance with pipe manufacturer's and Cast Iron Soil Pipe Institute's installation instructions. Vertical cast iron pipe and fitting installations above ground of all sizes shall be secured at each stack base and at sufficiently close intervals to keep the system in alignment and to adequately support the weight of the pipe and its contents.
- B. Unless noted otherwise on the Drawings, or required to suit final floor elevations, all storm piping 3" and larger shall be installed with a uniform minimum slope of 1/8" to the foot and all storm piping 2" and smaller shall be installed with a uniform minimum slope of 1/4" to the foot, or as otherwise required by local codes.
  - 1. Maintain 30" minimum ground cover above exterior piping.
- C. Interior storm drainage piping shall be hydrostatically tested after completion of the roughing-in. Piping being tested shall be filled to the top of primary roof drains or overflow drains and left standing for a period of one (1) hour with no loss of water. Smoke tests will be acceptable if required by local authorities. Confirm requirements prior to bidding.
- D. After testing and before final acceptance, the Contractor shall completely flush the entire storm systems and appurtenances included under this Contract in sufficient volume to remove all settlement and debris to obtain free flow through each pipe. Flushing shall be accomplished by the use of automatic flush tanks, fire hoses, or other means approved by the Architect. Depths of water and velocities shall be as required to produce a hydraulic bore. Remove all obstructions and correct all defects discovered.
- E. Exercise extreme care to prevent debris from entering primary roof drains, overflow roof drains, and cleanouts

### 3.4 FINAL INSPECTION

- A. At the time of final inspection of the work performed under the Contract, the roof drains, and cleanouts shall be complete in every respect and in perfect operating condition. All surplus materials of every description resulting from the work shall have been removed. Roof drains shall be free from debris, sand, silt or other obstructions. Any defects discovered in the roof drains and cleanouts subsequent to this inspection shall have been corrected.

END OF SECTION 221413

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## SECTION 221420 – WET – PIPE FIRE SUPPRESSION SPRINKLER SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. The General and Special Conditions and Section 220500, “Common Work Results for Plumbing” are included as a part of this section as though written in full in this specification. All fire protection system work shall be completed by a licensed, certified, Fire Protection Contractor acting as a subcontractor to the Plumbing Contractor. All work shall be directly coordinated with the local Fire Department.
- C. All pipe materials shall be subject to the acceptability of that material with the prevailing local fire and plumbing codes and NFPA 13.
- D. The Drawings and Specifications for this project are generally schematic and are intended for bidding purposes only and are not intended to cover each item required for a total system as outlined in NFPA 13. The minimum spacing, quantity and arrangement of proposed sprinkler locations, equipment, and piping indicated on the Drawings generally are diagrammatic. The exact arrangement, sizes, quantity and spacing required by the agencies having jurisdiction shall be indicated on the Working Drawings that are to be prepared by the Contractor.

#### 1.2 SCOPE

- A. The fire protection work to be performed shall include the following, but not necessarily limited to:
  - 1. Include all fire protection demolition work as shown on the drawings and as required for a complete installation of the fire protection system.
  - 2. Furnish and install Contractor-hydraulically designed wet fire protection systems, including all required drain piping and accessories, complete in every detail.
  - 3. Directly after award of Contract, regardless of dates of existing flow tests; or flow test data obtained or shown on any drawings; and prior to any submittal, the Contractor shall be responsible for conducting and obtaining new flow test data. Obtain water flow, pressure, capacity data, elevations, and other related pertinent information from the nearest available fire hydrant(s), and as arranged with the Water Authority serving the building. Arrange any times and dates with the Water Authority. Water flow test data obtained from the Water Authority will not be acceptable, regardless of when such flow tests were performed. Include all costs involved with obtaining the flow test data, including the use of special tools, equipment, and accessories and include in the Contract Bid. Typed copies of confirmed flow test results shall be furnished by the Contractor to the Professional and the Architect. Approval by the Architect of Contractor’s test results is necessary prior to forwarding submittals or beginning any work.
  - 4. Include all tests, permits, and fees, including all costs involved.

5. Contractor shall complete all Contractor's Material and Test Certificates for above ground installations.

### 1.3 CODE COMPLIANCE

- A. All fire protection work, and materials herein described shall comply with all applicable federal, state, county, health, and local laws, ordinances, rules and regulations, and all other local authorities having jurisdiction and shall be subject to the approval of these authorities, notwithstanding anything in these specifications to the contrary. In addition, all work and materials to be provided under this Section of the Specification shall conform to the applicable requirements of the National Board of Fire Underwriters Standards, and the National Fire Protection Association Standards; special reference is made to NFPA 13, Standard for the Installation of Sprinkler Systems. All threads shall conform to the local Fire Department Standards; confirm prior to ordering.

### 1.4 SHOP DRAWINGS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for all fire protection materials and products.
- B. Approval Drawings: All fees for this approval shall be by this Contractor. Prepare approval drawings of the fire protection systems coordinated with other mechanical, electrical, structural and general building drawings, of the fire protection systems proposed by the Plumbing Contractor and submit prints of the drawings to the appropriate governmental, health, and underwriting agencies for their review and approval. Prints bearing the approval stamp of the Underwriting Agency, authorized Fire Marshal and other Authorities having jurisdiction shall be submitted to the Architect prior to the commencement of any fabrication or installation of any portion of the system. The drawings shall include all of the following information and whatever additional information that may be required by the authority having jurisdiction.
  1. All sets of drawings with appropriate NFPA standards listed.
  2. System type.
  3. Total number of risers.
  4. Sprinkler spacing and locations with dimensions showing all lighting fixtures, diffusers and return air grilles.
  5. Occupancy type.
  6. Hazard classification.
  7. Hangers, types and details.
  8. Temperature and type of sprinkler heads.
  9. Sprinkler system accessories and specialties.
- C. Approval Calculations: Prepare hydraulic calculations of fire protection systems to determine all pipe sizes. Submit to Agency having jurisdiction for approval. Submit one (1) approved copy, bearing stamp and/or signature of Agency having jurisdiction to the Architect before proceeding with the installation.
- D. Certificate of Installation: Submit certificates upon completion of fire protection work which indicates that work has been installed and tested in accordance with NFPA 13, and also that the system is operational, complete and has no defects.



- E. Record Drawings: At project closeout, submit record as-built drawings of installed fire protection piping and products.
- F. Maintenance Data: Submit maintenance data and parts lists for fire protection materials and products. Include this data, product data, shop drawings, approval drawings, approval calculations, certificate of installation and record drawings in maintenance manual.

## PART 2 - PRODUCTS

### 2.1 FIRE PROTECTION PIPING AND EQUIPMENT INSIDE BUILDING

- A. Pipe:
  - 1. All wet system piping herein specified shall be UL Listed and FM Approved. Pipe shall be as manufactured by Allied Tube & Conduit, Youngstown Tube Co., or Wheatland Tube Company. For the wet-pipe systems only, all piping that utilizes threaded fittings shall be Schedule 40 black steel. "Plain-end" pipe/fittings and threadable light-wall pipe are not permitted. Sprinkler piping 1-1/4" in diameter or larger, connected by welded, flanged fittings or roll grooved fittings, shall be Schedule 40 or Schedule 10 as permitted by NFPA 13. Cut grooves are not permitted. All sprinkler piping 2" in diameter and smaller (that is not roll grooved or welded) shall be Schedule 40 utilizing screwed fittings (plain end fittings will not be accepted). All miscellaneous drain and test piping and fittings shall be Schedule 40, internally and externally galvanized. All piping shall include factory coating of the inner wall of piping, to guard against MIC (microbiologically influenced corrosion). The coating shall adhere to the wall of the pipe, thereby providing protection against contamination and pipe deterioration by impeding the attachment of microbes to the pipe wall.
- B. Hangers for the fire protection system shall be UL Listed, FM approved. Contractor's attention is directed to "Unsupported Armover Lengths", for pipe hanger installations for pressures above and below 100 psi, in accordance with NFPA 13
- C. Fittings:
  - 1. For wet-pipe system, 150 psi, screwed malleable iron, or Victaulic FireLock ductile iron fittings and FireLock EZ ductile iron, Nibco Steelok, or Tyco couplings for grooved end piping. Grooved end fittings and couplings shall be UL Listed and FM approved and shall be the products of a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.
  - 2. Grooved mechanical rigid type couplings consist of two (2) ductile iron housings cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13. 1-1/4" through 4" sizes shall be Victaulic Firelock EZ Style 009H "Installation Ready", or approved equivalent, stab-on coupling for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts. 5" and larger shall be Victaulic FireLock Style 005 or Style 07 Zero-Flex, or approved equivalent, standard rigid couplings.
  - 3. Flexible type couplings shall be used in seismic areas where required by NFPA 13. 2" through 8" sizes shall be Victaulic Style 177 QuickVic, or approved equivalent, coupling designed for direct installation onto grooved end pipe without prior field disassembly.

4. Coupling gaskets shall be pressure responsive, synthetic rubber, Grade "E" EPDM Type A, pre-lubricated for wet pipe systems.
- D. Valves shall be as manufactured by Nibco, Victaulic, or Tyco.
1. For sizes 2" and smaller, valves shall be bronze ball type, 175 pound WWP minimum, UL, FM, threaded or grooved body style, the Victaulic FireLock Series 728, or approved equivalent. The Nibco No. T-104-0, threaded, UL, FM valve, bronze gate, 175 pound WWP minimum, will be acceptable, or approved equivalent. For sizes 2-1/2" and larger, valves shall have iron body, 200 pound WWP minimum, UL, FM, with resilient wedge, flanged ends, the Nibco F-607-RW, grooved ends, Victaulic Series 771, or approved equivalent.
  2. Butterfly valves will be acceptable, UL, FM. Milwaukee "Butterball" butterfly valves, or approved equivalent, UL, FM, will be acceptable. Grooved end butterfly valves UL, FM, with weather-proof actuator and pre-wired supervisory switches monitoring the valve in the open position shall be Victaulic FireLock Series 705 (300 psi) or Series 765 (365 psi) maximum CWP, or approved equivalent.
  3. Check valves 2" and smaller shall be bronze, 200 pound WWP minimum, threaded, renewable rubber disc, and shall be the Nibco No. KT-403-W, or approved equivalent. Check valves 2-1/2" and larger shall have iron body, renewable seat and rubber disc, 175 pound WWP minimum, flanged, UL, FM, and shall be the Nibco No. F-908-W, or approved equivalent. Grooved end check valves shall have ductile iron body, stainless steel or EPDM coated ductile iron disc, UL, FM, and shall be Victaulic Series 717 (250 psi) or Series 717H (365 psi), or approved equivalent.
  4. Inspector's test and drain valves shall be 175 pound WWP minimum, bronze screwed, angle, or straight globe valves, UL Listed, rubber disc, the Nibco No.'s KT-65 UL, KT-67 UL, KT-211-W-UL, or approved equivalent. The Nibco No. KT-580-70-UL and No. KT-585-70-UL, threaded, bronze ball valves, UL listed, 175 pounds WWP, will be acceptable.
- E. Sprinkler Heads: All sprinkler heads shall be the product of a single manufacturer, UL Listed, and FM approved. All heads shall be the same model year and style throughout. The Architect must approve any deviations. Sprinkler heads shall be of a type, upright, pendent, or sidewall that is best suited to the conditions in which they are installed. Heads shall be as manufactured by Viking, Tyco, or Victaulic. Provide quick response sprinkler heads where required, in accordance with NFPA requirements. Heads which must be painted, shall be factory-painted only. Where required, heads shall be of a design suited to the protection of areas having irregular building design and structural arrangements such as cornices, soffits, beams and columns or building environmental systems such as light fixtures, grilles and diffusers, or building furnishings and equipment. Full consideration shall be given in the spacing of heads, of the type of head, and the arrangement of the piping to afford the protection required to be installed. Temperature ratings of all heads shall be coordinated with the NFPA 13 requirements. Provide higher temperature heads near heat – producing equipment. The Victaulic "strapless" style sprinkler heads will not be acceptable. The finish and type of sprinkler heads in finished areas must be approved by the Architect.
1. In general, sprinkler heads in finished areas with ceilings shall be semi-recessed type, chrome finish, the Viking Model M (QR, 5.6K, VK302), Victaulic Model V27, or approved equivalent.

2. Sprinkler heads in unfinished areas installed on exposed piping shall generally be of the upright type having rough bronze finish, the Viking Model M (QR, 5.6 K, VK300), Victaulic Model V27, or approved equivalent.
  3. In areas subject to corrosive atmosphere, heads shall be lead coated, Nickel-Teflon coated, or wax coated as required.
  4. Guards shall be provided on all heads subject to mechanical damage where normal movement of equipment or products would present a hazard to the sprinkler head, Viking Model D-1 Guard, or approved equivalent, such as equipment rooms, storage rooms, and similar areas. All sprinkler heads in areas throughout the building that are below 7 foot clearance shall be equipped with head guards. Sprinkler head guards shall be listed, supplied, and approved for use with the sprinkler, by the sprinkler manufacturer.
  5. Coordinate installation of sprinkler heads with surface mounted lighting fixtures for proper clearances.
  6. Install sprinklers under all ducts or obstructions greater than 48" in width in accordance with NFPA 13.
- F. In accordance with UL listing requirements, protective caps or straps shall be required for all glass bulb sprinklers. The caps or straps shall be removed from the sprinklers only when the system is "placed in service", in accordance with NFPA definitions. Protective caps and straps shall be removed only using means in accordance with manufacturer's installation instructions. "Dropped" glass sprinklers, with or without protection, shall be replaced. Solder element sprinklers are not required to be protected with caps or straps.
- G. The Contractor shall modify the existing fire protection piping and sprinkler head locations as required to suit the revised ceiling construction. Coordinate all requirements with the General Contractor. Furnish and install new sprinkler heads.
- H. Flushing: Completely flush out new and existing affected piping systems included under this Contract.
- I. Escutcheons: All pipe escutcheons shall be chrome, cast brass, set screw type, refer to Section 220500 for particulars.
- J. Signs: Furnish and place operation signs and other signs where required, Potter-Roemer, Inc., Reliable, or Viking.

### PART 3 - EXECUTION

#### 3.1 SPRINKLER SYSTEM INSTALLATIONS

- A. All systems shall be fully automatic, shall be complete in all detail, and shall be provided with all the required components and devices necessary to install approved systems.
- B. The layout of the sprinkler system, the arrangements of the heads; and the location and size of main and branch piping shall be developed from the design requirements of the applicable sprinkler criteria and the limitations imposed by the structural and architectural design. However, the degree of protection, hence the exact spacing and arrangement of the sprinkler heads and pipe sizes in any area shall be as required by the authority having jurisdiction.

- C. Rearrangement of branch piping and adjustment of the pipe sizes, where proven by hydraulic calculations and when approved by the authorities having jurisdiction, and where compatible with the building design, may be made in the preparation of the Shop Drawings.
- D. In finished areas, sprinkler heads shall be uniformly spaced and patterned to suit the ceiling finishes, decorations and interferences. In unfinished areas, the pattern of spacing and the coverage shall be as determined by the shape of the space and the interferences caused by construction details and the furnishings of the space. Maximum spacing shall not exceed that permitted by the authority having jurisdiction. Sprinkler heads in "lay-in" ceilings shall be centered in both directions.
- E. Additional spare sprinkler heads of each type shall be provided to the Owner. Not less than six (6) heads or 2% of the total number of each type of head shall be furnished to the Owner for storage. Furnish and install a metal wall storage cabinet, mounted where directed by the Architect. Storage cabinet shall be as manufactured by Tyco, Victaulic, or Viking. A wrench suited to each type of head shall also be provided in the cabinet.
- F. Test pipes with control valves shall be provided as required in the fire protection system. Closing of all sprinkler control valves and other impairments to the sprinkler fire protection system shall be coordinated closely with the Owner's maintenance personnel.
- G. All flow switches, monitor switches, and similar equipment must be accessible to local fire officials, regardless of location, exposed or concealed.
- H. Grooved joint piping systems shall be installed in accordance with the manufacturer's guidelines and recommendations. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

### 3.2 FIRE PROTECTION SYSTEM TESTS

- A. Before the completed fire protection system is accepted by the Owner, the entire new and existing affected system included under this Contract shall be pressure tested by the Contractor and approved in the presence of representatives of the Owner, the Architect, local Fire Department, local authorities, the Insurance Underwriters, and any other parties directly concerned.
- B. This Contractor shall furnish all labor and equipment and shall conduct and bear the cost of all required tests of the fire protection system. This Contractor shall give all concerned parties three days advance notice of scheduled tests; 48 hours to Water Authority
- C. The entire new fire protection system included under this Contract shall be tested under a hydrostatic pressure of not less than 200 lbs. for at least two (2) hours, or at 50 psi in excess of the maximum static pressure when the maximum static pressure is in excess of 150 psi, or as

otherwise required or directed by the local Fire Department. Testing of underground service main piping shall conform to NFPA 24 requirements. All defective work shall be promptly repaired or replaced with new pipe and fittings, etc.

- D. On existing sprinkler systems, modifications affecting 20 or fewer sprinklers or modifications that cannot be isolated, such as relocated drops and new connections, shall not require testing in excess of system working pressure.
- E. Tests shall be repeated until the installation receives the approval of the Architect and all parties concerned.
- F. Any damage resulting from the tests shall be repaired and/or damaged materials replaced, all to the satisfaction of the Architect, at the expense of this Contractor.

END OF SECTION 221420

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## SECTION 221429 – PLUMBING PUMPS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The pumps shall each be as described in this section, of sizes and capacities as noted on the Drawings.
- B. The pumps shall each be installed in accordance with the prevailing local plumbing codes.
- C. All pumps must be accessible.
- D. Refer to “Electric Motors”, Section 220500.

### PART 2 - PRODUCTS

#### 2.1 DOMESTIC HOT WATER RECIRCULATING PUMPS (HWCP)

- A. HWCP – Hot Water circulating pumps shall each be of all bronze construction or stainless steel construction, lubricated, the Bell and Gossett Booster Series, Taco, or Grundfos. Provide an aquastat to control each pump operation. Refer to the schedule shown on drawings for capacities.
  - 1. Circulating pump providing circulation between heater and storage tank shall be the B & G Series, Taco, or Armstrong, furnished by the heater manufacturer for installation under the Plumbing Contract.
- B. Power wiring will be furnished and installed under the Electrical Contract. Manual motor starters shall be furnished under the Plumbing Contract and delivered to the Electrical Contractor for installation. All control wiring required to operate aquastats and pumps shall be included under this Contract, of type specified.

#### 2.2 ELEVATOR SUMP PUMP WITH ALARM SYSTEM

- A. ESP – Furnish and install (1) Weil Pump Company 1456-OSS Series, Liberty, or Armstrong, permanent submersible simplex sump pump in elevator shaft pit, hermetically sealed capacitor start motor with built-in overload protection and Class F insulation, air filled. Pump, end bell and motor shell shall be cast iron, cast iron impeller, 303 stainless steel shaft, factory sealed grease lubricated ball bearings, mechanical seal, and perforated 304 stainless steel strainer. Pump shall have 15 ft. long power cord with three (3) prong grounded plug. Refer to the schedule shown on drawings for capacities.
  - B. Sump pump pit with cover will be constructed under the General Contract.
  - C. Discharge piping shall include a ball valve and a check valve, of types specified, at locations indicated on the Drawings.
  - D. Pump controller shall operate independent of alarm and shall be the SEEwater, Inc., Model OSS20PBPR Oil Smart Pump Controller only. Installation shall allow water to be pumped automatically without the risk of pumping oil. Pump Controller with “on” and “off” sensors using capacitive technology to ensure that oil shall not harm or contaminate the sensors. Sensors shall oscillate through the oil to work properly and to avoid contamination. Pump controller shall be stand-alone. Pump controller shall be independently UL listed and meet the Standards of UL 508A for industrial controls to ensure reliability.
  - E. Alarm Panel shall be the SEEwater, Inc., Model OSA-05 Oil Smart Alarm. Alarm panel shall be CSA certified, or equivalent. The panel shall include the following features:
    - 1. High Liquid Alarm, Liquid Smart® Sensor shall differentiate between oil and water with combination capacitive/optic technology. Liquid Smart® sensor shall detect any liquid and identify if liquid is oil or water at any given point. Alarm, light, and dry contacts for oil present or water present.
    - 2. Panel shall include visible mounted features including: yellow light to indicate oil present, white light to indicate water present, alarm test button, and alarm silence button.
    - 3. NEMA 4X weather-tight corrosion resistant polycarbonate enclosure, IP-56 Rating.
  - F. Install the oil sensor control high liquid alarm system per manufacturer’s written installation.
  - G. Install control and alarm panel unit at location designated on the drawings.
  - H. The Contractor shall determine and verify the exact length of run required between the oil sensor control high liquid alarm system panel and the elevator pit junction box and obtain the required length of cabling from the manufacturer. The maximum length of cable is 150’.
  - I. All wiring and conduit from the panel to the pump shall be included under the Plumbing Contract; all power wiring to the control panel, only, will be included under the Electrical Contract.
- 2.3 DUPLEX SUMP PUMP
- A. Furnish and install a duplex submersible pumping system with sump pump basin. Pumps shall be Weil Pump Company, Inc. only, submersible type, Model 1418 for sump service. Refer to the schedule shown on drawings for capacities.



- B. The pump casing shall be one piece, cast iron construction with integral tripod support legs which provides an even distribution of weight, and cast iron suction strainer.
- C. Pump motors shall each be vertical, NEMA-6. They shall be air filled, hermetically sealed with built-in auto-reset thermal/overload protection.
- D. Motor end bell shall be designed as a terminal box and separated from the motor shell by a combination bearing support and inspection plate.
- E. Motor shall be housed in a watertight cast iron shell Class F insulation with permanently lubricated upper and lower ball bearings. Motor shaft shall be 300 series stainless steel. Motors using sleeve type bearings, carbon steel shafts or motors requiring water cooling jackets shall not be considered equivalent.
- F. The impeller shall be multi-vane semi-open type and shall be made of bronze. All impellers shall be dynamically balanced.
- G. A single mechanical seal with carbon ceramic seal faces shall be provided.
- H. The pump casing shall be one piece cast iron constructed with center-line discharge connection to accept Weil Series 2613 system only. This allows the pump to be raised and lowered without disturbing the discharge piping. Stationary elbow discharge connection shall be suitable to accept plain end of ANSI flanged pipe.
- I. A mechanical automatic alternator shall be provided.
- J. Controls shall be micro pressure switches. Pump shall be arranged for high water alarm level. Provide red bell for alarm, 4" diameter minimum, mounted by Plumbing Contractor.
- K. All power wiring by Electrical Contractor; all control wiring by Plumbing Contractor.
- L. Furnish and install a suitably sized cast iron basin. Furnish and install a cast iron or heavy duty, steel cover to suit the sump basin, of type and openings to suit the pump installations, with required openings for mechanical and electrical services.
- M. Furnish and mount a duplex control panel for the pump, complete with all factory-installed standard controls and alternator.
- N. Pump manufacturer shall set on-off level controls, and high water alarm level to suit pump basin design and depth.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install each pump in accordance with manufacturer's written recommendations and installation instructions.

- B. For each recirculating pump, furnish and install a ball shutoff valve and strainer on inlet piping to the pump, with a balancing cock on outlet piping. Furnish and install a check valve where shown.
- C. Place each pump in service and check power draw, voltage, and proper system operation. Report the actual current draw and pump flow, and other information for each pump. Provide written results to the Owner.

END OF SECTION 221429

## SECTION 223300 – DOMESTIC WATER HEATING EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. Furnish and install gas-fired domestic water heating boiler/storage tank unit, complete with expansion tank, equipment and associated accessories, as shown on the Drawings. – AND/OR –
- B. Furnish and install gas-fired/electric domestic water heater, complete with expansion tank, equipment and associated accessories, as shown on the Drawings. – AND/OR –
- C. Furnish and install electric point-of-use water heater as shown on the Drawings.

#### 1.3 CODE COMPLIANCE

- A. Water heater shall be installed in accordance with and shall meet or exceed the energy efficiency requirements set forth by applicable portions of The International Energy Conservation Code, and all applicable state, federal, and local codes having jurisdiction.

### PART 2 - PRODUCTS

#### 2.1 DWHB-1 – DOMESTIC WATER HEATING BOILER AND STORAGE TANK

- A. Bryan Water-Pak System Forced Draft Model No. DR650WT-FDG-335-AV-CM-IN only. Heater shall be of vertical design, factory assembled and wired with interconnecting pipe and controls. The only field connection requirements shall be the cold water inlet, hot water outlet, fuel, boiler make-up water with pressure reducing and backflow preventer devices, electrical, and vent. The indirect water heater shall be manufactured and stamped in strict accordance with ASME Code, Section IV. Heater water tubes shall be easily removable and replaceable without requiring welding or rolling. An in-line induced draft fan shall be furnished under this Contract by the heater manufacturer. Refer to the schedule shown on drawings for capacities.

- B. The water heater shall be furnished complete with one or more indirect heat exchangers installed in the upper drum of the heater, heat exchangers being capable of absorbing 100% of the total heater output. Heat exchangers shall be attached to heater shell by means of a gasket and stud type connection and shall be easily removable and replaceable.
- C. The water heater shall be complete with an insulated metal jacket, consisting of not less than 1-1/2" fiberglass insulation and a heavy gauge zinc-coated steel casing, painted with a suitable heat-resisting primer and lacquer. Complete jacket and insulation shall be readily removable and re-installed if necessary. Combustion space shall be lined with insulating tile or board and no part of the jacket shall be exposed to the products of combustion.
- D. The storage tank section shall be manufactured in strict accordance with ASME Unfired Pressure Vessel Code Section VIII, for a maximum working pressure of 150 psi. Storage tank shall be lined with cement. All threaded tank connections shall be stainless steel. Storage tank shall be mounted in a vertical position. A 12" x 16" manhole shall be provided on the tank. Manhole shall also be cement lined.
1. Tank manufacturer will supply and install, in the field, Iniflex vinyl coated 3.125" foam insulation over entire storage tank, to effect an insulation R value of 12.5.
- E. An all bronze circulating pump shall be factory installed to provide circulation between the storage tank and the water heater. All piping shall be copper and brass. The water heater, storage tank and all piping and accessories shall be mounted on a full-length structural steel channel base, set on a concrete pad. Insulate heater/tank circulating piping as specified.
- F. Heater Trim - The water heating boiler shall be furnished with the following fittings and trim:
1. Bronze automatic boiler fill valve.
  2. Heater water temperature control.
  3. Heater high limit control.
  4. ASME expansion tank.
  5. Tank temperature control.
  6. Temperature gauge on storage tank.
  7. Combination thermometer and pressure gauge.
  8. ASME safety relief valves for heater and tank and heat exchangers.
  9. Low water cutoff on heater.
  10. Shut-off valves between heater and tank.
  11. Heater and tank drains.
  12. Unions at coil and tank connections.
  13. A properly sized in-line induced draft fan.
- G. Install the ASME expansion tank as listed above, for the heater installation, as furnished by the heater manufacturer, complete with proper ASME relief valve.

- H. Forced Draft Gas Burner and Control Equipment – The gas burner unit shall be an integral part of the water heater. Burner shall be arranged for forced draft operation. The burner shall be equipped with an automatic electrically operated gas valve, a gas pressure regulator and manual shutoff valve. Gas pilot safety control shall shut down burner in case of pilot failure. A suitable barometric draft control or draft diverter shall be furnished. Burner shall be designed to operate between 7" and 14" w.c. gas pressure. Burner unit shall operate at 1-60-120V. service.
- I. Gas valves on gas supply piping to boiler shall be full port type as specified.
- J. The following additional controls and accessories shall be furnished:
1. Hi-low-off, two-stage, gas burner controls
  2. Electronic pilot safety controls on forced draft gas burner
  3. National Board stamp
  4. UL/FM/CSD-1 gas train
  5. Electric ignition
  6. Start-up and one (1) year service
  7. Two-position draft damper with control interlock
  8. "Boiler Protector" low water cutoff and high limit aquastat
  9. Contacts for interface with combustion air damper, emergency shutdown switches, etc.  
Provide all emergency shutdown switches at all exits of the room where the boiler is housed, if there are no HVAC boilers in the same room.
  10. Maxon 5000 safety gas valve
  11. Honeywell S7800A1001 program display
  12. Boiler tube replacement tools and tube brush
- K. Furnish and deliver to the Owner where directed, the following spare parts and equipment for the water heating boiler unit:
1. Copper indirect heat exchanger.
  2. Six (6) spare boiler tubes.
  3. Honeywell combustion programmer to match original equipment.
  4. Motorized modulating gas valves to match original equipment, of proper number designated by the manufacturer's representative.
- L. Relief valves not furnished by the heater manufacturer shall be set at 125 psig.
- M. All relief tappings on burner assembly, such as gas regulator equipment, shall be piped full-size to atmosphere above the roof, through the roof or wall construction. Termination shall be no less than 20' from air intakes or building openings. Provide required flashing and sealing. Use Schedule 40 ASTM A-53 black steel pipe and fittings. Do not combine relief tapping piping; run separately.
- N. Complete flue venting system will be by the HVAC Contractor. Furnish and deliver to the HVAC Contractor for installation, the in-line induced draft fan furnished under this Contract by the heater manufacturer.
- O. Point of Use Chemical Feeder
1. Furnish and install for the domestic water heater, a combination chemical pot feeder and filter. Vessel shall be rated for a minimum of 300 psig working pressure with a feeder

- capacity of 2.5 gallons. Unit shall have an integral filter bag assembly supported by a removable stainless steel basket, a wide mouth opening to facilitate easy filling and bag removal. Filter feeder shall provide continuous filtration when not in service as a chemical feeder. Filter bags shall be provided under this Contract to filter loop water to 20 microns.
2. Filter feeder shall be installed on inlet water piping to the boiler as detailed. Shut-off valves shall be installed on inlet, outlet and drain in order to provide isolation and draining for filling with chemical and removal and cleaning of filter bags when full. Unit shall be State Chemical Part Number 102456 Filter Feeder. (Representative: Chris Cascino, Johnstown, PA, Tele No. 814-242-7542), Mogul, Wessels, or approved equivalent.
  3. Mount unit in line with top approximately 48" above finished floor, or at height directed by the Architect.
- P. Furnish Owner with sufficient fully illustrated instruction manuals and parts lists for the heater and storage tank.

## 2.2 DWHB-2 – DOMESTIC WATER HEATING BOILER WARRANTY RENEWAL

- A. Retain the local Bryan Boiler manufacturer's representative, for the purpose of performing and warranting a complete Warranty Renewal on the existing Bryan Indirect domestic water heating boiler, Model Number CL-48-WT-G.
- B. The work to be included in order to issue the new warranty shall be as follows:
  1. Remove existing boiler tubes and replace with new tubes.
  2. Remove existing ribbon atmospheric burners and replace with new burners.
  3. Remove existing low water cutoff and replace with new updated version.
  4. Remove existing ASME relief valves and replace with new updated version.
  5. Remove existing pressure/temperature gauge and replace with new gauge.
  6. Remove existing copper immersed heat exchanger and replace with new exchanger.
  7. Remove entire existing gas train and replace with upgraded new train, which will comply with IRI insurance requirements, and also will include a new Maxon 5000 safety auxiliary gas valve.
  8. Remove existing circulating pump between indirect water heater and storage tank and replace with a new bronze type, recirculating pump adequately sized.
  9. Remove all existing aquastats from the indirect water heater and replace with new aquastats.
  10. Remove all loose paint, debris, dirt and grease from outer jackets via sandblasting and/or scraping, and re-paint with upgraded Bryan corrosion-resistant zinc-based paint.
  11. Remove all deteriorated inner jacket insulation and replace with upgraded version of fiberglass.
  12. The water heater manufacturer's representative shall supply the new heater/tank circulating pump and the required controlling aquastat to control the pump to the Plumbing Contractor for field installation.
  13. Perform complete combustion analysis on unit, including result for CO, CO<sub>2</sub>, O<sub>2</sub>, gas pressure, draft, stack temperature and combustion efficiency.
  14. Other than required by the Owner, remove all discarded boiler material from jobsite and properly dispose of same.

- C. When completed, the Owner shall receive a written, 10 year non-prorated Warranty covering all parts and labor, commencing upon the date of the Owner's acceptance and date of final payment. Refer to "Warranties", Section 220500. Also included shall be a published list of all office phone and cell phone numbers for all individuals responsible for the implementation of the Warranty and all service required.
- D. Existing flue piping shall remain as presently installed.

2.3 DWH-1 – GAS-FIRED DOMESTIC WATER HEATER

- A. Natural gas water heater shall be A.O. Smith Cyclone HE Model No. BTH series, Lochinvar Shield Series, State Premier Series, American Standard HE Series, or Bock OptiTherm series, with up to 90% thermal efficiency, maximum hydrostatic working pressure of 160 PSI. Refer to the schedule shown on drawings for capacities.
  - 1. Seamless glass-lined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded.
  - 2. Spiral-shaped heat exchanger placed entirely inside the tank, which shall be glass-lined to protect against acidic flue gas condensate.
  - 3. Foam or fiberglass insulation and an ASME-rated temperature and pressure relief valve.
  - 4. Down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up; 5. Have advanced electronic controls. Furnish Owner with sufficient fully illustrated instruction manuals and part lists for the heater.
- B. If water heater exceeds 119 gallons storage, and/or burner exceeds 199,000 Btu/hr input, tank must meet ASME ratings.
- C. Heater shall be supplied with an anode. Extend condensate drain piping and terminate over nearest drain.
- D. Heater shall include an electronic Intelli-Vent gas control valve, equipped with a premium grade silicon nitride hot surface ignitor, or equivalent. This valve shall feature advanced electronic circuitry for precise temperature control and LED display of temperature settings and diagnostic codes for easy temperature adjustment and troubleshooting.
- E. The heater shall be suitable for sealed combustion direct venting using PVC or CPVC exhaust pipe and PVC or CPVC intake pipe, or other pipe as recommended by the manufacturer, complete with factory terminal fittings. Exhaust and intake piping shall be extended and terminated at exterior of building as shown, in strict accordance with heater manufacturer's installation instructions. PVC pipes shall not be installed above ceilings where ceiling plenums are used to retain air. Use metallic piping or suitable flame/smoke rated piping.
- F. Furnish and install an expansion tank for the heater, of suitable capacity for the heater, of type specified.
- G. Provide and install a concentric vent arrangement, as instructed by manufacturer, for water heater. Concentric termination shall be AO Smith Part # 9006328005.

2.4 DWH-2 – ELECTRIC HOT WATER HEATERS

- A. Each heater shall be the A.O. Smith Water Products Company Dura-Power Supreme Commercial Electric Model Number DSE or DEN Series, Lochinvar, State, or Bradford White. Heater shall be glass-lined, listed by Underwriters' Laboratories and approved by the National Sanitation Foundation. All internal surfaces of the tank shall be glass-lined with an alkaline borosilicate composition that has been fused to steel by firing at a temperature range of 1600 degrees F. Electric heating elements shall be medium watt density screw-in type. Tank shall be cathodically protected with adequate extruded magnesium rod. The entire vessel shall be enclosed in a round steel enclosure with baked enamel finish. Control compartment shall be hinged and shall house 120 volt control circuit transformer, transformer fusing, magnetic contactors, immersion style operating thermostats, high limit thermostats, element fusing per N.E.C., and commercial guide incoloy sheathed flange mounted elements with prewired terminal leads. Temperature controls, include limiting switch which will require resetting manually in the event the temperature reaches 190 degrees F. The heater tank shall have a three (3) year limited warranty. Heater with foam insulation (R-16) shall meet or exceed latest requirements of ASHRAE 90.1b-1992 for heat loss efficiency. Fiberglass insulation acceptable. Unit shall include brass drain valve, ASME temperature and pressure relief valve, and 4" x 6" handhole cleanout. Refer to the drawing details. Furnish Owner with sufficient fully illustrated instruction manuals and parts lists for the heater. Refer to the schedule shown on drawings for capacities.
- B. Furnish and install an expansion tank for each heater, of suitable capacity for the heater, of type specified.
- C. Provide a Modulating Controller for all water heaters that require multiple immersion heaters. Controller shall be provided by Water Heating Manufacturer, and the controller shall stage the immersion heaters as needed.
- D. All power wiring for electric heaters will be included under the Electrical Contract; all control wiring by Plumbing Contractor.

2.5 DWH-3 – ELECTRIC INSTANTANEOUS WATER HEATER

- A. Water heater shall each be the Eemax Thermostatic Series, PVI, or Chronomite Laboratories, Inc. Unit shall include microprocessing temperature control capable of maintaining outlet temperature of +/- 1 degree F. accuracy. Refer to the schedule shown on drawings for capacities.
- B. Heater shall be white in color. Unit shall have an ABS-UL 94Vo rated cover. Element shall be replaceable cartridge insert. Unit shall have a replaceable filter in the inlet connector. Element shall be iron free, nickel-chrome material. Heater shall be fitted with 1/2" pipe compression nuts or sleeves to eliminate need for soldering. Heater shall include flow switch to activate heater only on demand. Maximum operating pressure shall be 150 PSI. Provide temperature/pressure relief valve if required by local codes. Heater shall be UL Listed.
- C. Warranties: Replaceable cartridge element shall be warranted for one (1) year. Heater shall be guaranteed against failure due to leaks of "heater body/element assembly" for a period of five (5) years.



- D. Furnish Owner with sufficient fully illustrated instruction manuals and parts lists for the heater.

## 2.6 STEAM HOT WATER HEATERS

- A. Semi-instantaneous heater will be Cemline Model V45SSH1024 factory assembled and packaged. The heater shall be fabricated in accordance with ASME code and stamped for 150 psi working pressure. The packaged water heater will be constructed with a 316-L Stainless steel tank and 316-L Stainless steel threaded openings. Heater will be mounted on a steel support skid and will have lifting lugs. Heater will be insulated with 3" fiberglass protected by an enameled metal jacket, 20 gauge thickness. Heater will be factory assembled and piped including:
  - 1. Incoming steam strainer
  - 2. Electronic operated temperature regulator
  - 3. Main and auxiliary float and thermostatic steam traps
  - 4. "U" bend coil, ½" copper tubes, copper lined tube sheet and cast iron steam chamber.
  - 5. Intra tank circulator
  - 6. ASME pressure- temperature relief valve
  - 7. Water pressure gauge and steam pressure gauge
  - 8. Cem-trol® Solid State Control module that includes the following functions with individual pilot lights: On-off switch, remote start-stop, alarm horn with alarm silence button, power on, primary high limit, and secondary high limit. Module will have built in PID Control signal with LED display of set point and operating temperature read out and contacts for Building Automation
  - 9. Double solenoid safety system
  - 10. Vacuum Breaker
- B. Heater shall be rated to heat 125 gpm of water from 40 F to 140 F and control the outlet within 5 degrees of the selected temperature when supplied with 27 PSIG of saturated steam to the control valve.
- C. Heater will be mounted vertically
- D. Tank Components
  - 1. Main Steam Strainer – 3" NPT Cast Iron
  - 2. Control Valve – Valve Pro Electronic Operated. 3" 2-way Valve Body – REV-I-4-300-2W-24V-FS. Maximum Shut-Off pressure – 125 psi @ 281 F.
  - 3. Cem-trol Solid state control module with two (2) temperature sensors with one (1) thermowell for secondary sensor. Cem-trol to include the following functions:
    - a. Built in On/Off switch, Remote start/stop, Alarm horn, 24 VAC relay for primary and secondary high temperature limits.
    - b. PID control signal. 0-10 VDC output signal for modulation of control valve.
    - c. Built in LED display of set point, operating temperature, and output voltage.
    - d. Built in LCD display of function and alarms: Power on, primary high limit, and secondary high limit.
    - e. Built in contacts to notify B.A.C. of functions and alarms: Power on, primary high limit, secondary temperature limit, call for heat (contact open when control valve is

- closed), any alarm, and operating temperature (4-20mA).
- f. Built in: input for remote temperature control (4-20mA input signal).
4. Double Safety System – 3/4" Water dump solenoid required to be piping to drain in the field by the Plumbing Contractor.
  5. Main Steam Trap – Pennant PT64H-50 2"
  6. Auxiliary Steam Trap – Pennant PT63-30 3/4"
  7. A..S.M.E. Temperature-Pressure Relief Valve – Watts LFN240X-6 1" F.N.P.T. Set at 160# 1 required. Required to be piped to drain in field by the Plumbing Contractor.  
A..S.M.E. Pressure Only Relief Valve – Watts LF174A 3/4" F.N.P.T. x 3/4" F.N.P.T. Set at 160# 1 required. Required to be piped to drain in field by the Plumbing Contractor.
  8. Component Piping.
  9. Coil: 1230AA 1/2" O.D. x 20 BWG copper tube, Copper lined tube sheet, copper baffled, 12" – 150# 2 pass cast iron coil head.
  10. All Bronze Intertank Circulator – Bell & Gossett: PL-75B-LF 2" Wired to On/Off switch.
  11. Temperature Gauge – digital readout on Cem-trol
  12. Vessel Pressure Gauge – CC-102D-354CH 3 1/2" Dial 0-300#
  13. Source Steam Pressure Gauge – Range 30" x 60# with vacuum breaker.
  14. Single point wiring
  15. 4" - 150# flanged cold water inlet & hot water outlet
  16. Water heater shall comply with lead free laws
  17. Non-stock Tank – Model# V60SSH1230. Tank dimensions are 24" diameter x 36", 60 gallon capacity. 150 psi working pressure at 210°F and 195 psi test pressure. Tank will be mounted vertically. Heater rated to heat 125 G.P.M. from 40°F - 140°F when supplied with 27# steam to the control valve.

## 2.7 EXPANSION TANKS

- A. Furnish and install an ASME expansion tank for the hot water system, potable type, similar to the Watts DETA Series, Wessels Company, or Amtrol, of required capacity. Tank shall be pre-charged, field adjustable, carbon steel, with FDA approved bladder, stainless steel system connection, and charging valve. Tank must be constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code, with prime painted exterior. Insulate expansion tank as specified. (Heater shall also be furnished with an expansion tank as shown and hereinbefore specified and shall also be insulated as specified.) Expansion tanks shall each be furnished with an ASME pressure relief valve as designated by the Maryland Department of Labor and Industry regulations. Valve inlets to each tank.

## 2.8 RELIEF VALVES

- A. Refer to Section 220523, "Domestic Water Valves".

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Furnish and install thermometers and pressure gauges at locations shown or specified for the water heating piping and equipment, of types specified.

END OF SECTION 223300

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## SECTION 224000 – PLUMBING FIXTURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The plumbing fixtures, trim, accessories, and miscellaneous equipment shall be as shown on the drawings. Additional manufacturer's names of fixtures, trim, and miscellaneous equipment shall be listed herein.
- B. All plumbing fixtures and trim shall be new and of the best quality. All fixtures shall bear the manufacturers' guarantee label or trademark, indicating first quality.
- C. ALL fixtures and associated trim, including traps, stops, faucets, flush valves, etc., shall be 'Lead Free' or 'No Lead' and shall be documented as such as part of the submittal process.
- D. All vitreous china, cast iron, and prefabricated fiberglass, polyethylene, acrylic, or polypropylene fixtures shall be white and all fixtures of all types shall be specially selected, free from cracks, chips, flaws, stains and warping, and other defects. Fixtures shall be replaced by the Contractor, and the guarantee period on such replaced fixtures shall be extended for the full term of the guarantee from the date of replacement.
- E. The Contractor shall refer to the Drawings for the quantities of plumbing fixtures of each kind to be furnished.
- F. Provide adapters on all final piping connections to equipment furnished under other contracts or by the Owner.
- G. All fixtures and trim shall be as listed below. Confirm requirements of all fixtures, trim, and manufacturers with Owner prior to ordering. Trim shall be commercial grade. Fixtures to match existing building's fixtures.
  - 1. Water Closets, Urinals, Lavatories– Zurn, American-Standard Brands, Gerber, Kohler, or Sloan.
  - 2. Utility Sinks – Zurn, Florestone, or Fiat.
  - 3. Stainless Steel Sinks – Just, Advance Tabco, or Elkay.
  - 4. Electric Water Coolers / Bottle Fillers – Oasis, Elkay, Haws, Halsey Taylor.
  - 5. Water Closet / Urinal Flush Valves – Zurn Aquavantage Only, Sloan Royal only, American Standard, or Kohler.
  - 6. Lavatory / Sink Faucets – Zurn, Chicago Faucet, Speakman, Delta, or T&S Brass.
  - 7. Fixture Support Carriers – Zurn, Josam, Smith, Wade, or Watts.
  - 8. Waste/Trap Assemblies – Zurn, McGuire Mfg., or Kohler.
  - 9. Water Supplies/Stops – Zurn, McGuire Mfg., or Kohler.

10. Insulation Kits – Zurn, McGuire, or Truebro.
- H. All fixtures and equipment shall be properly trapped in accordance with local code requirements.
- I. All exposed piping to fixtures shall be chrome plated. Chrome traps and chrome tubing shall be 17 gauge minimum. All traps of all types, exposed and accessible concealed, shall each include cleanout. Chrome finishes shall not be required for fixtures that require insulation kits.
- J. All escutcheons shall be chrome, cast brass, set screw type, including on drain assemblies, water supplies at fixtures, and including piping inside fixture cabinets.
- K. Plumbing Contractor shall furnish templates to General Contractor for cut-out work for built-in sinks and lavatories. Confirm available cabinet sizes with the General Contractor or Equipment Supplier prior to ordering counter sinks or counter lavatories of any type.
- L. Rigidly secure flush valve supply piping so that valves do not move. Include suitable piping support adapters, as manufactured by Sioux Chief Manufacturing, or approved equivalent. Split ring chrome flush valve supports acceptable.
- M. Supply piping to fixtures, faucets, shower heads, wall hydrants, and hose bibbs shall be securely anchored to prevent movement.
- N. All ADA water closet flush valve handles shall be mounted on wide side of toilet areas.
- O. Contractor shall coordinate all installations with Architectural Drawing elevations and ADA required clearances.

## PART 2 - PRODUCTS

### 2.1 FIXTURES

- A. FD – Floor Drains
  1. Refer to Specification Section 221316 “Sanitary Waste and Vent Piping” for all floor drain types.
- B. L-1 – Lavatory-Stage Integral Unit
  1. Lavatory to be a complete 3-stage lavatory system, Bradley ‘Verge with Washbar Technology’ LVQ Series. Model # LVQD3-WB1-A50-TMA. Chrome-Plated WashBar with Infrared Control, 0.50 gpm PCA Silicone Tip, Thermostatic Mixing Valve Assembly. Coordinate all accessories with architect and owner prior to submittal. Provide all traps, stops, and accessories for a complete fixture installation.
- C. MB-1 – Mop Basin
  1. Zurn No. Z1996-24-SD-BS-WG-HH-MH mop basin, 24” x 24” x 10” high, with stainless steel dome strainer and 3” outlet, of color selected by Architect. Complete with four (4) stainless steel rim guards; back and side 24” stainless steel wall guard panels, of number

required by the installation, Type 304, 20 gauge; 30" heavy duty 5/8" rubber hose/bracket combination and mop hanger bracket, stainless steel, 24" x 3" wide. Use silicone sealant caulk on all wall and floor contact edges.

2. Faucet shall be Zurn No. Z843M1-RC faucet with vacuum breaker spout, pail hook, wall brace, lever handles, and rough chrome plate finish.
  - a. Furnish and install check valves in hot and cold water piping serving the combination faucet.

D. S-1 – Drop In Single Bowl Stainless Steel Sink with Manual Faucet – Disabled Height

1. Just Company SL-ADA-2019-A-GR, single bowl, Type 304, 18-8, 18 gauge stainless steel countertop ledgeback sink unit, 20"x19", 5" deep, three (3) hole punch. Sound deadened. Self rim. Fixture and faucet shall be ADA compliant, arranged for disabled use, with center-rear drain.
2. Zurn No. Z831J1-ICT-XL 'Lead Free' **manual** faucet with swing spout, lever handles, and aerator.
3. Just J-35 stainless steel drain and tailpiece assembly with 1-1/2" Schedule 40 PVC adjustable P-Trap and waste assembly.
4. Water supplies shall be Zurn Z8800-XL-LRLK-PC. Brass ball valve type "convertible" stops acceptable.
5. Zurn No. Z8946-3-NT ADA compliant insulation kit for waste and hot and cold water assemblies, vandal-resistant; when exposed to users.
6. Sink countertop openings by General Contractor. Sink set and sealed by Plumbing Contractor.

E. S-2 – Wall-Mounted Stainless Steel Bowl with Manual Faucet – Disabled Height

1. Regency 12"x16" Wall Mounted Hand sink. 20 gauge type 304 stainless steel construction. Fixture shall be provided with hanger plate and holes for concealed arm carrier systems. Mount at ADA Height.
  - a. Zurn Series Z1231-79 carrier. Use Z1231-D-79 carrier where back-to-back installation is practical. The Zurn "EZ Set" lavatory support system will be acceptable. Zurn "CB" carrier bank supports acceptable.
2. Drain shall be Zurn No. Z8746-PC flat perforated strainer drain with 1-1/4" offset tailpiece.
3. P-Trap assembly shall be Zurn No. Z8701-9-PC, 1-1/4" x 1-1/2", with cleanout.
4. Water supplies shall be Zurn Z8800-XL-LRLK-PC. Brass ball valve type "convertible" stops acceptable. Provide Zurn No. Z8946-3-NT ADA compliant insulation kit for waste and supply assemblies.
5. Faucet to be integral with the sink unit.

F. S-3 – Floor-Mounted Triple Bowl Stainless Steel Unit with Manual Faucet – Disabled Height

1. John Boos "EUB" EUB3S72-2D 72"x21" Floor mounted under bar triple bowl sink. 20 gauge type 304 stainless steel construction. Two drain boards on each end of the triple bowl. Fixture shall be provided with hanger plate and holes for concealed arm carrier systems. Mount at ADA Height.

- a. Zurn Series Z1231-79 carrier. Use Z1231-D-79 carrier where back-to-back installation is practical. The Zurn "EZ Set" lavatory support system will be acceptable. Zurn "CB" carrier bank supports acceptable.
2. Drain shall be Zurn No. Z8746-PC flat perforated strainer drain with 1-1/4" offset tailpiece.
3. P-Trap assembly shall be Zurn No. Z8701-9-PC, 1-1/4" x 1-1/2", with cleanout.
4. Water supplies shall be Zurn Z8800-XL-LRLK-PC. Brass ball valve type "convertible" stops acceptable. Provide Zurn No. Z8946-3-NT ADA compliant insulation kit for waste and supply assemblies.
5. Faucet to be integral with the sink unit.

G. U-1 – Wall-Mounted Bowl with Manual Flush Valve – Standard Height

1. Vitreous china Zurn No. Z5755-U, wall hung, 1 gallon per flush, washout urinal with 3/4" top spud, integral elongated flushing rim, integral trap, wall hangers, and 2" flanged outlet connection.
  - a. Zurn Series No. Z1221 or No. Z1222 carrier as required for the accepted fixture. Zurn "CB" carrier bank supports acceptable.
2. Manual Flush Valve shall be Zurn No. Z6003AV-WS1, 1.0 gpf.

H. U-2 – Wall-Mounted Bowl with Manual Flush Valve – Disabled Height

1. Vitreous china Zurn No. Z5755-U, wall hung, 1 gallon per flush, washout urinal with 3/4" top spud, integral elongated flushing rim, integral trap, wall hangers, and 2" flanged outlet connection. ADA Compliant.
  - a. Zurn Series No. Z1221 or No. Z1222 carrier as required for the accepted fixture. Zurn "CB" carrier bank supports acceptable. Mount at ADA Height.
2. Manual Flush Valve shall be Zurn No. Z6003AV-WS1, 1.0 gpf.

I. WC-1 – Wall-Mounted Water Closet with Manual Flush Valve – Standard Height

1. Vitreous china Zurn No. Z5615-BWL, 1.6 gallon per flush, low consumption, siphon jet, elongated bowl, wall mounted closet with 1-1/2" top spud and bolt caps.
  - a. Zurn Z5955SS-EL-AM-STS, heavy duty, anti-microbial, commercial grade, open front, plastic seat less cover, with self-sustaining stainless steel concealed check hinges.
  - b. Zurn Series Z1203, Z1204, Z1208 and Z1209 carriers, with (XH) extra-heavy-duty 750 lb. load-rated. Match carrier selection to specific piping configuration and wall type. Include rear stabilizer support for carrier and wall finishing frame. Waste outlet seal ring must be neoprene or graphite – felt. Do not use a wax ring. Inform Carrier Supplier to include additional auxiliary support and extension assemblies and couplings to accommodate the closet installations.
2. Manual Flush Valve shall be Zurn No. Z6000AV-HET, 1.28 gallon per flush.
3. Manual Flush with Bedpan Washer and Offset for Handicap Grab Bar Valve shall be Zurn Exposed Z6011AV-BWN-WS1, exposed, bedpan washer, offset for grab bar installation, elongated neck, 1.6 gpf.



J. WC-2 – Wall-Mounted Water Closet with Manual Flush Valve – Disabled Height

1. Vitreous china Zurn No. Z5615-BWL, 1.6 gallon per flush, low consumption, siphon jet, elongated bowl, wall mounted closet with 1-1/2" top spud and bolt caps, ADA Compliant.
  - a. Zurn Z5955SS-EL-AM-STS, heavy duty, anti-microbial commercial grade, open front, plastic seat less cover, with self-sustaining stainless steel concealed check hinges.
  - b. Zurn Series Z1203, Z1204, Z1208 and Z1209 carriers, with (XH) extra-heavy-duty 750 lb. load-rated. Match carrier selection to specific piping configuration and wall type. Include rear stabilizer support for carrier and wall finishing frame. Waste outlet seal ring must be neoprene or graphite – felt. Do not use a wax ring. Inform Carrier Supplier to include additional auxiliary support and extension assemblies and couplings to accommodate the closet installations.
2. Manual Flush Valve shall be Zurn No. Z6000AV-HET, 1.28 gallon per flush.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All fixtures, trim, accessories, and equipment shall be assembled and installed according to manufacturers' recommendations in a neat and workmanlike manner.
- B. Thoroughly clean all fixtures, trim, accessories, and equipment installed under this Contract.
- C. Refer to the Architectural and Plumbing Drawings for scheduled mounting heights and clearances for fixtures and equipment. Particular attention is directed to mounting and clearances for ADA fixtures.
- D. Upon completion of this Contract, the Plumbing Contractor shall furnish the Owner's maintenance personnel with a Supplier faucet repair kit furnished by the approved faucet supplier.
- E. Caulk with white silicone sealant caulk on all wall and floor contact edges on all fixtures, or of color caulk selected by the Architect. Caulk shall be of suitable type which can be painted.
- F. Individual mixing valves shall be utilized at certain fixtures and equipment receiving hot water as designated; refer to Section 220523 regarding mixing valve specifications. The Plumbing Contractor shall verify exact requirements, quantities, and locations of mixing valves with the local Plumbing Inspector prior to ordering or installation.

END OF SECTION 224000

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## SECTION 230505 – HVAC SCOPE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 EQUIPMENT AND SYSTEMS PACKAGING

- A. Equipment and product manufacturers specified in the Section 23 documents are encouraged to form vendor teams where practical to provide equipment in competitively priced packages.

#### 1.3 DESCRIPTION OF WORK

- A. The work to be performed under these Specifications and the accompanying Drawings comprises the furnishing of the labor, materials, tools, and other services and facilities necessary for the complete installation of, but not necessarily limited to the following:
  - 1. Demolition of HVAC equipment, ductwork, and piping as indicated on the drawings.
  - 2. Packaged Rooftop Units
  - 3. Hot Water Boiler-Wall Hung
  - 4. Terminal Equipment – Constant and Variable Volume Boxes, Air Curtains, Electric Baseboard
  - 5. Piping – Hot Water, Refrigerant, Condensate Drain
  - 6. Piping Specialties, Valves, Hangers and Supports
  - 7. Exhaust Fans, Miscellaneous Ventilation Systems
  - 8. Underfloor Heat Systems
  - 9. Ductwork – Low and Medium Velocity
  - 10. Ductwork Accessories – Dampers, Grilles, Registers, Diffusers, Supports, Silencers, Access Doors, and Turning Vanes
  - 11. Insulation – Piping, Equipment, Ductwork
  - 12. Circulating Water Pumps – Hot Water
  - 13. Water Treatment – Closed Loop
  - 14. Equipment and Piping Identification
  - 15. Testing, Adjusting, and Balancing
  - 16. A new DDC Automatic Temperature Control system. The system shall include new control panels, control wiring, control valves, thermostats, switches, relays, controllers, and other accessories herein specified.
  - 17. Furnish combination starter/disconnects, disconnect switches, magnetic motor starters, manual motor starters and fuses to the Electrical Contractor for installation on the HVAC Equipment. Coordinate the electrical requirements with the Electrical Contractor before ordering any such equipment.
  - 18. Install duct-mounted smoke detectors. Furnish and install the control wiring from the duct-mounted smoke detectors to the air handling unit motor starters for unit shutdown.

Duct-mounted smoke detectors shall be furnished and connected to the fire alarm system by the Electrical Contractor.

#### 1.4 WORK BY OTHERS

- A. The following construction and equipment related to the work under this Contract will be provided by others:
1. Openings in new roof and roof deck. (General Contractor)
  2. Openings in new exterior walls. (General Contractor)
  3. Furring around new piping. (General Contractor)
  4. Final painting of new interior surfaces. (General Contractor)
  5. Recesses and openings in new construction for piping and equipment. (General Contractor)
  6. New chases for piping where specifically shown on the drawings. (General Contractor)
  7. Funnel and floor drains required for the various equipment. (Plumbing Contractor)
  8. The removal of existing electrical wiring, conduit and boxes for existing removed heating and ventilating equipment. (Electrical Contractor)
  9. The line and load side electric power wiring to the new electrically operated heating, ventilating and air conditioning equipment (Electrical Contractor). The control and interlock wiring, both low and line voltage shall be included under the HVAC Contract as hereinafter specified for the HVAC equipment.
  10. The Electrical Contractor shall be responsible for the power wiring and associated terminations to line and load side as well as mounting of the combination starter/disconnects, magnetic starters, VFD's, manual starters, disconnect switches, etc. furnished by the mechanical contractor and external to equipment they are designated to serve. The Electrical Contractor shall make final connections to the equipment as directed by the Mechanical Contractor.
  11. Furnishing of duct mounted smoke detectors (Electrical Contractor). Wiring to fire alarm system by Electrical Contractor.

#### PART 2 – PRODUCTS

##### 2.1 NOT APPLICABLE TO THIS SECTION

#### PART 3 - EXECUTION

##### 3.1 NOT APPLICABLE TO THIS SECTION

END OF SECTION 230505

## SECTION 230506 - BASIC HVAC MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 DEFINITIONS

- A. The word "building" used throughout these specifications shall be interpreted to mean the entire Building Complex.
- B. Where the phrase "or approved equivalent," "or equivalent" or "approved" appears in these specifications, it shall refer to the approval of the Architect on the material or equipment involved.
- C. The terms "The Contractor" or "This Contractor" or "the HVAC Contractor" mentioned in these specifications refers to the Contractor responsible for the work and equipment included in these specifications.

#### 1.3 CODES AND STANDARDS

- A. The work shall be executed and the equipment constructed and installed in accordance with the requirements of the State Building Code, the Department of Labor and Industry, ASME, Department of Environmental Resources, Department of Labor, Safety and Health Regulations for Construction, OSHA, National Fire Protection Association, the National Electrical Code as amended to date of bidding, and applicable federal, state, county and local ordinances and regulations.
- B. Nothing contained in these specifications or shown on the drawings shall be construed to conflict with the aforesaid codes, ordinances, or regulations.

#### 1.4 PERMITS AND CERTIFICATES

- A. The fees and permits required shall be satisfied and obtained by the Contractor and the cost shall be included in the Contract price.
- B. Certificates of approval shall be obtained from any department issuing same and shall be turned over to the Owner at the completion of the work.

#### 1.5 QUESTIONS AND CLARIFICATIONS OF BID DOCUMENTS

- A. Bidders shall not rely on any verbal clarification of the Drawings and Specifications.
- B. Any questions or clarifications shall be referred to the Engineer at least seven (7) working days prior to bidding to allow for issuance of an addendum.

#### 1.6 GENERAL REQUIREMENTS

- A. **No piping, ductwork or equipment shall be installed without first obtaining sign off from the other trades. Should such installation occur, and then subsequent conflicts arise, this Contractor shall, at his own expense, remove that which is in conflict and reinstall appropriately.**
- B. The Contractor shall visit the site and thoroughly acquaint himself with conditions existing at the site before submitting his proposal as he will be held responsible for the complete installation of the work in every detail.
- C. The Contractor shall carefully examine the general building drawings and the mechanical and electrical drawings and carry on his work so as not to delay or interfere with the work of other trades. He shall obtain in writing from the other contractors such data as is necessary to coordinate his work with other trades.
- D. Carefully examine the drawings included under this Contract and drawings included under other contracts and report any discrepancies noticed to the Architect as this contractor shall be responsible for the HVAC system installation in its entirety.
- E. The drawings are diagrammatic and generally indicative of the work to be installed. Due to the small scale of the drawings, it is not possible to indicate all offsets, fittings, valves, dampers, access panels, and similar parts which may be required. The Contractor shall carefully investigate the structural and finish conditions affecting the work and arrange his work accordingly, furnishing necessary parts and equipment as may be required to meet the various conditions.
- F. The work shown on the drawings and not specifically included in the specifications shall be considered a part of the Contract work. The work included in the specifications and not specifically included on the drawings shall also be considered a part of the Contract work.
- G. The Contractor will be responsible for the completion of the work included under this Contract and shall employ skilled and qualified tradesmen as necessary to satisfactorily complete the work and trades.
- H. The work shall be installed subject to the approval of the Architect.

#### 1.7 SCHEDULE OF WORK

- A. The Contractor shall arrange his work to comply with the Architect's schedule and the published or revised phasing schedule.
- B. The Contractor shall submit a complete schedule of work to the Architect for approval at the beginning of the Contract in accordance with the phasing schedule.

- C. The schedule shall clearly indicate the proposed order in which the various parts of the work will be undertaken, and the estimated time required for the completion of each particular part of the work.
- D. The work shall be coordinated with work being performed by contractors of other trades, with the Owner and phasing schedule.
- E. The installation of equipment shall follow the phasing schedule.
- F. The Contractor shall especially review the phasing schedule and ensure compliance with this schedule.
- G. The schedule of work may be revised periodically during the course of construction, but each revised schedule must be approved by the Architect.

#### 1.8 SHOP DRAWINGS AND SUBMITTALS

- A. Refer to Architect's specifications for submittal requirements.
- B. A complete list of materials proposed for each installation shall be submitted to the Architect for review before delivery to the site.
- C. Prior to the installation of any equipment or materials, submit shop drawings and manufacturer's data for the items listed in the Submittal Log (Attachment A) in accordance with the Contract Documents.
- D. Submittal Log (Attachment A) shall serve as the Contractor's checklist to assure the complete submission of the required shop drawings and manufacturer's data.
- E. Equipment and materials furnished as part of this Contract shall be submitted for review whether listed on Submittal Log (Attachment A) or not.
- F. The submissions are the Contractor's documents, and the Architect's and Engineer's review or acceptance constitutes an acknowledgment that the documents have been submitted and nothing more.
- G. It is the Contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.
- H. **Any deviations from the design documents must be clearly identified so that the Engineer may properly review such items.** It shall not be the Engineer's responsibility to search out these deviations. If such deviations are not properly flagged for the Engineer's review, the Contractor shall be completely responsible for the consequences that might result from the deviations.
- I. The Contractor shall submit samples of materials for approval at the site as requested by the Architect. Such materials may be incorporated into the structures after serving their purpose as samples.

- J. At the close of the job, prior to final review, five (5) bound copies of operations and maintenance (O&M) manuals shall be submitted by transmittal to the Engineer for review and acceptance. In lieu of hard copy O&M manuals, the Contractor may submit two (2) copies on CD format containing PDF files. O&M manuals, regardless of format, shall include the following:
1. Equipment warranties.
  2. Contractors' warranties.
  3. Parts list and manuals for the equipment.
  4. Operating instructions (in writing).
  5. Written instructions on maintenance and care of the systems.
  6. Lubrication and recommended spare parts.
- K. Submit Record (As-Built) Drawings. Refer to Paragraph 3.3

#### 1.9 SUBSTITUTIONS

- A. Where the Contractor elects to substitute approved materials or equipment for materials or equipment specified, as the basis of design. The Contractor will be held responsible for the structural, mechanical, and electrical changes required for their installation at no additional cost to the Owner. If additional engineering design is required, the Contractor shall reimburse the design engineer for the related costs.
- B. Throughout the Specifications, types of materials may be specified by manufacturer's name and catalog number in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the bidder may assume the phrase "or approved equivalent," except that the burden is upon the bidder to prove such equality. If the bidder elects to prove such equality, he must request the Architect's approval in writing to substitute such item for the specified item, and shall submit supporting data, and samples if required, to permit a fair evaluation of the proposed substitution with respect to quality, serviceability and warranty. Data pertinent to the proposed substitution shall be submitted to the Architect at least 10 days prior to the bid date for evaluation and review purposes. If the Architect accepts the proposed substitution, an addendum will be issued to the bidders advising them that this substitution will be acceptable from each bidder.
- C. Substitutions of equipment other than that specified must be very carefully checked to assure that no problems will occur due to dimensional differences, code requirements, connection points, weights, etc. Where the Contractor elects to substitute materials or equipment approved by the Architect for those specified, the Contractor will be held responsible for the architectural, structural, mechanical, and electrical changes required for the installation of the substituted materials at no additional cost to the Owner. Tests required to substantiate the equivalence of the material will be the obligation of the Contractor.



- D. When this Contractor desires to furnish equipment of a manufacturer other than that specified or intended, he shall include a complete specification of the substituted item, along with each submission copy of shop drawings, indicating the necessary modifications to the substituted product to satisfy the requirements of the Contract Specifications. Manufacturer's specifications shall be written as close as possible over the Contract Specifications and each paragraph shall bear the same paragraph number as the Contract Specifications so that close comparison can be made. Submissions will be rejected should they not include the comparison specification. Comparison specification shall be submitted for approval 10 days prior to the Bid Date. If prior approval is not obtained, no substitutions will be considered, and the Engineer reimbursed for time spent to reject and return such submission.
- E. The verification specification shall include the exact wording of the Contract Specification and the revised wording identified properly indicating each deviation proposed. If no deviations are noted, the Contractor must furnish the material or equipment in accordance with the Contract Specifications.
- F. Should the Contractor elect to propose a substitution after the project has been awarded, the Contractor will be billed for the time spent by the Architect and his consultants in evaluating the proposed substitution. This billing shall occur whether the proposed substitution is accepted or rejected and shall be at the rate of the direct cost to the Architect times a 2.5 multiplier.
- G. The submissions are the Contractor's documents, and the Architect's and Engineer's approval constitutes an acknowledgment that the documents have been submitted and nothing more. It is the Contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.

#### 1.10 DRAWING DIMENSIONS, GRADES, AND ELEVATIONS

- A. Contractor shall layout his work from dimensions of Architectural and Structural Drawings and actual dimensions of equipment being installed.
- B. Layouts in congested areas should not be scaled from Mechanical and Electrical Drawings. Clearances shall be provided on each side of the equipment as required for proper maintenance purposes and as required by the Department of Labor and Industry, OSHA and the National Electrical Code.
- C. Grades, elevations and locations shown on the drawings are approximately correct; however, the Contractor shall field check and otherwise verify grades, elevations, locations, and dimensions at the site before proceeding with the work.
- D. The Contractor shall make necessary survey equipment available during construction and shall make use of such equipment wherever necessary to properly install his equipment.

#### 1.11 MECHANICAL PLANS

- A. The mechanical plans are intended to be diagrammatic and are based on one (1) manufacturer's equipment.

- B. They are not intended to show every item in its exact location, the exact dimensions or the details of the equipment.
- C. The Contractor shall verify the actual dimensions of any specified or substituted materials and equipment to ensure that they will fit in the available space.
- D. The apparatus shall be located as closely as conditions will permit and deviations there from shall be made only with the consent of the Engineer and without additional charge.
- E. The right is reserved by the Engineer to make any reasonable changes in the location of the equipment prior to rough-in without invoking additional expense.
- F. This contractor shall be responsible to create and distribute for sign-off amongst other trades ductwork and HVAC piping coordination drawings. Refer to Subsection 3.5 for further clarification.

#### 1.12 EQUIPMENT AND MATERIALS

- A. Equipment and materials shall be manufactured in accordance with national standards established by manufacturer's associations, engineering and testing societies, such as NBMA, NEMA, ASTM, AMCA, ASME, ANSI, ACI, etc., where such standards have been established.
- B. Equipment shall be furnished by authorized manufacturer's representatives only. There shall be no exceptions to this requirement.
- C. In each case where equipment and materials are specified in the singular or plural number, it is intended that such reference shall apply to as many such items as are required to complete the installation.
- D. Equipment and materials of similar types shall be of the same manufacturer unless specifically indicated otherwise on the drawings or herein specified.
- E. Materials shall be strictly in accordance with the quality, style, and sizes as specified herein.
- F. Manufacturers' names and plate numbers are given in the specifications to denote a standard of quality, style, size, and type and shall exclude material of other manufacturers.
- G. The Contractor shall make final connections between equipment furnished under this Contract and equipment furnished under other contracts as noted.
- H. The materials used throughout shall be those of reputable manufacturers and shall be new and the best of their respective kinds.
- I. Equipment, components and materials shall be installed in a neat and workmanlike manner in accordance with best trade practices, manufacturer's recommendations, and applicable codes and standards and by men skilled in each particular trade of the work assigned to them.
- J. The Contractor shall properly lubricate the moving parts of equipment and appurtenances installed under this Contract.

1.13 STORAGE AND PROTECTION OF EQUIPMENT AND MATERIALS

- A. The Contractor shall be entirely responsible for the apparatus, equipment and appurtenances furnished by him or his Subcontractors in connection with the work, and special care shall be taken to protect each component thereof in such manner as may be necessary or as may be directed.
- B. Protection shall include covers, crating, sheds, or other means to prevent dirt, grit, plaster, or other foreign substances from entering the working parts of machinery or equipment.
- C. Special care shall be taken to keep the open ends of pipes, ductwork, VAV/CAV Boxes and other equipment, etc., closed while in storage and during installation.
- D. Where equipment must be stored outside the building, it shall be fully covered and secured with heavy waterproof tarps and kept dry.
- E. Where equipment has been subjected to moisture, it shall be suitably dried out before placed in service.
- F. Piping, ductwork, materials and equipment shall be stored in areas as designated by the Architect.

1.14 LOCATIONS OF EQUIPMENT

- A. The actual runs and locations of the piping, ductwork, equipment, etc., shall be determined at the site and shall be installed to meet the various conditions at the building.
- B. It is the HVAC Contractor's responsibility to predetermine the exact locations of ductwork, piping, and equipment, and to notify the other contractors accordingly to avoid conflict with other lines and equipment.
- C. Any changes necessary to conceal pipes, ductwork or clear pipes and equipment of other trades shall be made without additional expense to the Owner.
- D. This Contractor shall be responsible to create ductwork and HVAC piping coordination drawings and distribute to other contractors for coordination and sign off. Refer to Subsection 3.5 for further clarification.
- E. The Architect/Engineer reserves the right to revise locations of piping, ductwork, locations of equipment, etc., within the building as long as sizes remain the same.

1.15 CONSTRUCTION PENETRATIONS AND OPENINGS

- A. The General Contractor will provide chases and openings in walls, floors, ceilings, and partitions of new construction to receive pipe lines, risers, ducts, and other equipment insofar as it is possible to predetermine the exact location, but the Contractor shall install his work sufficiently in advance of the building construction to permit his work to be built into place.

- B. The General Contractor will furnish openings for intakes in the new exterior walls of the building. These are located and shown on the Drawings and shall be coordinated between this Contractor and the General Contractor.
- C. This Contractor shall advise the General Contractor of the exact size and location of the chases and openings required for the installation of his work and shall check size and location of such chases and openings provided by the General Contractor.
- D. The Contractor shall furnish and place the sleeves required for pipes or ducts passing through new floors, walls and ceilings before such general construction work is built into place.
- E. The Contractor shall place the inserts required for hangers and supports, as the construction work progresses, so that unnecessary cutting of construction work will be eliminated.
- F. The Contractor shall do the cutting and patching required for the installation of his work.
- G. Where piping, ducts, or other equipment pass through existing or new fire or smoke barrier stops, walls, floors, or ceilings, this Contractor shall furnish and install sleeves and shall thoroughly seal openings around sleeves, pipes, etc. with fire and smoke resistant materials.
- H. Materials shall be furnished by the HVAC Contractor as required to maintain the fire rating of the walls, partitions, ceilings and floors in accordance with the requirements of NFPA, the state building codes and other applicable codes.

#### 1.16 HEATING AND COOLING DURING CONSTRUCTION

- A. Advance work as rapidly as possible to permit the heating and cooling systems to be used when it is required for each area of the building.
- B. The Contractor shall coordinate the operation of the system with the Owner so that heat remains on in each area during construction.
- C. Provide the required temporary heat as directed by the Construction Manager.

#### 1.17 TEMPORARY USE OF EQUIPMENT

- A. The permanent HVAC equipment, when installed, may be used for temporary services, with the consent of the Engineer. Should the permanent systems be used for this purpose the Contractor shall make each temporary connection required at his expense. The Contractor shall also repair or replace equipment as necessary due to damage, wear and tear, etc., leaving the same in "as new" condition.
- B. Permission to use the permanent equipment does not relieve the Contractor from the responsibility for any damages to the building construction and/or equipment which might result because of its use.
- C. A pre-start up conference shall be held with the Architect, Owner, Construction Manager, Engineer, and Mechanical Contractor. Equipment shall not be started until after this meeting.

- D. No unit shall be operated during construction phases that create excess dust, debris, or odors in the space on each floor, such as but not limited to: drywall installation, sanding, painting, wood cutting, etc. Each unit serving that space shall be shut down during construction phases that are associated with these types of activities and may only be restarted with the approval of the General Contractor and Engineer. Any damages, wear and tear, etc. resulting from use during unapproved times shall be the responsibility of the Mechanical Contractor to repair or replace as required at no additional cost to the project or owner.
- E. During each phase of construction:
  - 1. At a minimum, four complete sets of pre-filter media are required for each roof top unit. In each unit, install two sets of filter media during construction (more shall be required if construction activities dictate more frequent changes). In each unit, install one set of filter media at substantial completion. Leave one (1) set of filter media in boxes in an appropriate room as a spare set for the Owner. The other filters shall be used by the Contractor during construction. Dispose of the used construction filter media.
  - 2. On the outside face of each return air opening install a minimum of two (2) sets of fiberglass filter media, such as cheesecloth, to be utilized as pre-filters for the "construction" filters. Install first set upon start-up and then install second set when first set is dirty. Dispose of the dirty construction filters. Change filters as often as necessary to keep air handling units from becoming dirty at no additional cost.

#### 1.18 MANUFACTURER'S SERVICE PERSONNEL

- A. The Contractor shall furnish the services of manufacturers' representatives for the equipment furnished under these Contract Documents.
- B. The amount of factory service provided by the Contractor shall be as normally recommended and furnished by the various equipment manufacturers unless specified otherwise.
- C. Testing of such systems and equipment shall be made under the direct supervision of competent authorized service representatives and the Commissioning Agent.
- D. In the instance of Mechanical and Control systems, such as the major and special equipment, heating equipment, controls, fans, or similar miscellaneous systems and equipment, the installations, final connections and testing of such systems shall be made under the direct supervision of competent authorized service engineers who shall be employed by the respective equipment manufacturer and/or an authorized representative.
- E. The expenses incurred by these equipment manufacturers' representatives shall be borne by the Contractor.

#### 1.19 INSPECTIONS AND TESTS

- A. Prior to acceptance, the Contractor shall notify the Architect, in writing, when the installation is complete and ready for inspections and tests.
- B. Inspections and tests shall be conducted in the presence of the Architect and the Commissioning Agent to determine compliance with the contract documents.

- C. If the installation does not comply with the contract documents, the Contractor shall immediately correct each defect and shortcoming.
- D. Any additional tests that may be required shall be entirely at the Contractor's expense. Testing shall be completed as directed by the Architect before the system is accepted.

## PART 2 - PRODUCTS

### 2.1 ELECTRIC MOTORS

- A. The electrical motors furnished and installed under this Contract shall be manufactured by Reliance, General Electric, U.S. Motors, or approved equivalent and shall be of the proper type and frame of the services involved in accordance with the NEMA and Equipment Manufacturer's recommendations.
- B. Motors shall be "energy efficiency" type with 1.15 service factor. Motor windings shall be entirely copper. Where possible, motors shall be permanently lubricated.
- C. Where motors must be lubricated, the manufacturer shall furnish the services of a representative to review the lubrication procedure with the Contractor and the Owner and turn over to both of them a complete set of the necessary maintenance literature.
- D. Motors and installation shall conform to the applicable requirements of the National Electrical Code.
- E. Motors shall be suitable for across-the-line or reduced voltage starting as applicable in each instance.
- F. Motors shall be inverter rated when controlled by Variable Frequency Drives (VFD's).
- G. Provide the Electrical Contractor with the motor data to properly size overcurrent protection devices for each combination starter and disconnect switch.
- H. The HVAC Contractor shall be responsible for any additional costs to the Electrical Contractor resulting from any changes in motor sizes initiated by the HVAC Contractor, from sizes scheduled on the Drawings.

### 2.2 ELECTRICAL BEARING DAMAGE PROTECTION FOR MOTORS WITH VFD'S

- A. General Requirements – Shaft Grounding:
  - 1. Motors operated on variable frequency drives shall be equipped with a maintenance free, conductive micro fiber, shaft grounding ring with a minimum of two (2) rows of circumferential micro fibers to discharge damaging shaft voltages away from the bearings to ground.
  - 2. Application Note: Motors up to 100 HP shall be provided with one shaft grounding ring installed either on the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive

end of the motor. Grounding rings shall be provided and installed by the motor manufacturer or contractor and shall be installed in accordance with the manufacturer's recommendations.

B. General Requirements – High-Frequency Bonding:

1. Motors operated on variable frequency drives shall be bonded from the motor foot to system ground with a high frequency ground strap made of flat braided, tinned copper with terminations to accommodate motor foot and system ground connection.
2. Application Note: Proper grounding of motor frame for inverter-driven induction motors
  - a. References: ABB Technical Guide No.5
  - b. Allen Bradley Publication 1770-4.1 Application Data, Industrial Automation Wiring and Grounding Guidelines

C. Recommended parts:

1. Bearing Protection Ring
2. High Frequency Ground Strap

D. Acceptable Manufacturers:

1. Electro Static Technology-ITW  
Manufacturer of AEGIS® products.  
Phone: 207.998.5140  
Fax: 207.998.5143  
sales@est-aegis.com  
www.est-aegis.com

2.3 MANUAL MOTOR STARTERS

- A. Manual motor starters shall be furnished by this Contractor, for installation by the Electrical Contractor, for single phase fractional horsepower (1/2 horsepower and smaller) motors.
- B. Provide the motor electrical characteristics to the Electrical Contractor so the Electrical Contractor may size wiring.
- C. The Heating Contractor shall coordinate the starter control circuit transformer VA requirements with the ATC contractor prior to ordering starters.

2.4 MAGNETIC MOTOR STARTERS - FULL VOLTAGE

- A. Furnish to the Electrical Contractor for installation combination full voltage magnetic starters and fused disconnect switches for each 3 phase motor with service factor of 1.15.
- B. Starters shall have three (3) current overload relays and low-voltage release.
- C. Starters shall be furnished with hand-off-automatic switch, red run light, overload reset, a set of extra auxiliary contacts consisting of one (1) normally open and one (1) normally closed

contacts and a control transformer with 120 volt fused secondary control circuit and fused primary circuit.

- D. Starter enclosure shall be NEMA 1 enclosures. Furnish Allen-Bradley Bulletin 512 starters or equivalent as manufactured by Square D, General Electric or Siemens.
- E. Disconnect switches shall be horsepower rated to match the horsepower of the motors plus 1.15 service factors connected thereto as required.
- F. Where starters are separately mounted, they shall be of the magnetic type as herein specified.
- G. The magnetic motor starters for motors connected to the normal/emergency electrical distribution system shall be provided with an adjustable time delay unit. Time delay unit shall be capable of delaying motor starting from 0 to 180 seconds.
- H. The Heating Contractor shall coordinate the starter control circuit transformer VA requirements with the ATC contractor prior to ordering starters.

## 2.5 HAND-OFF AUTOMATIC (H.O.A.) SELECTOR SWITCHES

- A. The ATC Contractor shall furnish and install remote hand-off-automatic selector switches where shown or required and shall be the type that can be changed in the field from two (2) positions and vice versa.
- B. Switches shall have padlocking attachment that will permit locking in either the manual or automatic positions.
- C. Switches shall be furnished with NEMA Type 1 enclosures where installed remote from starter. Provide Cutler-Hammer three (3) position switches, padlocking attachment, or equivalent as manufactured by Square D, General Electric, or Siemens.
- D. Starter for the Emergency Generator Supply Fans shall be furnished with an "off-auto" selector switch in lieu of a "hand-off-auto" selector switch as the exhaust and supply fans should operate as a pair of fans.
- E. Starters for Stair Tower Pressurization Fans shall be furnished with "key" operable "hand-auto" selector switches in lieu of standard H-O-A selector switches.

## 2.6 SAFETY SWITCHES

- A. Safety Switches shall be furnished to the Electrical Contractor for installation.
- B. Safety switches shall be of the fusible type as indicated, quick-make, quick-break in NEMA Type 1 sheet steel enclosure unless otherwise noted.
- C. Switches shall be horsepower rated, and of size and number of poles as indicated on the Drawings. Safety switches shall be of type having a direct mechanical linkage between contacts and operating handle.



- D. Safety switches shall be as manufactured by Cutler-Hammer, General Electric, or Square D Company.
- E. Fuses for safety switches shall be of the UL Class RKI Low Peak as manufactured by the Bussmann Mfg. Division of the McGraw-Edison Company.
- F. Fuses for motors shall be sized to conform with the motor running current and in strict accordance with the recommendations of the fuse manufacturer.
- G. Where switches are located at the exterior of the Building or in wet locations, they shall be provided with NEMA 3R or 4 weather tight and weather resistant enclosures.
- H. Enclosures for switches located in hazardous areas shall be of the appropriate explosion proof type.
- I. Switches used as service entrance switches shall be Underwriters Laboratories listed suitable for Service Entrance Equipment.
- J. Disconnect switches serving remotely mounted soft starters or VFD's shall be furnished with a minimum of one (1) set of normally open auxiliary contacts.

## 2.7 ACCESS PANELS

- A. The HVAC Contractor shall furnish and install factory-fabricated access panels for access to concealed dampers, damper actuators valves, and other equipment where no other means of access is available. Access panels shall be of appropriate size but not less than 24" flush type, hinged to drop down and out, screwdriver-operated, stainless steel in tile work and prime coated sheet steel in plaster or acoustical tile of every type. The HVAC Contractor shall furnish and install access panels for the equipment installed under this Contract. Exact locations and sizes of panels shall be determined by the HVAC Contractor, but panels shall be located for a symmetrical appearance. Access panels are not required at lift-out removable tile ceilings.
- B. At locations where access panels are installed in existing or new fire-rated construction, access panels shall contain the 1-1/2 hour fire-rated "B" label; and in addition, shall also be provided with layers of gypsum wall board in a thickness which will supply an additional one (1) and two (2) hour fire rating equal to the fire rating of adjacent construction.
- C. Coordinate with the General Contractor on fire ratings of new and existing construction.

## 2.8 FIRE STOPPING

- A. The following fire stopping requirements constitute minimum requirements of this specification. The Contractor shall be aware of additional requirements by the Construction Manager, which may exceed or supersede this specification.
- B. Seal openings of fire rated construction with a material or product that has been tested at an independent testing laboratory, such as UL, FM, etc. Fire stopping shall conform to ASTM E-814 and UL 1479, with fire ratings equal to or exceeding the fire rating of the construction involved. Fire stopping shall be UL classified, and shall be similar to the 3M brand Fire Barrier

Penetration Sealing Systems, or approved equivalent. Fire stopping of this type shall also be utilized for openings through smoke rated construction.

- C. If desired by the Contractor and approved by local codes, the "Pro Set" piping penetration system also may be utilized. Penetration system shall be UL certified and shall be the "Pro Set" System A. Firestop coupling (sleeve) shall be filled with ceramic fiber material to provide insulation and fire stopping. System shall be capable of maintaining a 3-hour fire rating. Penetration system shall be secure, waterproof, fire rated, and smokeproof and shall allow for pipe expansion and contraction.

## 2.09 EQUIPMENT GUARDS

- A. Equipment guards shall be provided for protection at the belts, chains, gears, motors or other moving parts of equipment and machinery installed under this Contract.
- B. Guards shall be made up of suitable structural shapes and heavy gauge steel welded together and attached to equipment by removable clips and bolts.
- C. Guards shall be neat and substantial and shall be securely attached to equipment.
- D. After fabrication, guards shall be cleaned of rust and scale and painted with one coat of metal primer followed by two coats of enamel to match the equipment.
- E. Guards shall be easily removable for maintenance and service of equipment.
- F. Equipment guards shall conform to OSHA requirements.

## 2.10 MISCELLANEOUS IRON WORK

- A. The HVAC Contractor shall furnish and install the necessary structural steel members for the proper support of the piping, ductwork, and equipment furnished and installed under this Contract.
- B. Miscellaneous iron work shall include, but not be limited to, piping hangers, piping anchors and guides, ductwork supports, and any other equipment supports.
- C. Additional structural members shall be furnished and installed to support the heating, ventilating and air conditioning equipment without excessive stress or strain on the building construction.
- D. Structural beams and other structural members shall be furnished and installed under this Contract for anchors and guides where the building steel is not available or capable of supporting or anchoring pipe lines and equipment.
- E. The equipment and materials furnished and installed under this Contract which are not mounted on bases or floors shall be securely attached and supported from the main supporting structure of the building by metal hangers, clamps and/or brackets.

- F. Metal hangers, clamps and/or brackets shall be of suitable design and of sufficient strength to properly and safely support the materials and equipment involved.
- G. Lag screws and bolts shall be used where required at wood construction.
- H. Materials:
  - 1. Structural steel members for the support of equipment installed under this Contract shall conform to ASTM Specifications A-36 and shall comply with the latest requirements of the American Institute of Steel Construction.
  - 2. Structural steel shall be of standard sections as given in the structural steel manufacturers' handbooks.
- I. Anchors:
  - 1. The Contractor shall provide the anchors, bolts, screws, dowels, and connecting members and perform the cutting and fitting necessary to secure the work to adjoining construction.
  - 2. Build in connecting members to masonry, concrete, and structural steel as the new and remodeling work progresses.
- J. Supports and Brackets:
  - 1. Supports and brackets shall be neatly constructed of structural shapes to adequately support the equipment intended.
  - 2. The supports must be approved prior to installation. Field conditions will regulate the type of support.
- K. Priming and Painting:
  - 1. Before priming, the metal shall be thoroughly cleaned free from scale, rust, and dirt.
  - 2. The steel and iron work shall be primed with Rust-Oleum X-60, or approved equivalent.
  - 3. Paint final coat black on the miscellaneous steel installed under this contract by this Contractor.

## 2.11 FLASHINGS

- A. The Contractor shall furnish and install roof curbs as required for his equipment.
- B. The Contractor shall furnish and install pipe portals for pipes as required.
- C. An approved roofing sub-contractor, responsible to the Heating Contractor, shall install flashings at roof curbs and final roofing, to maintain the roof warranty.

## PART 3 - EXECUTION

### 3.1 CLEANING

- A. As the work in the building nears completion, threading, cutting, etc., shall be done where directed by the Architect.
- B. Upon completion of the work, the remaining waste materials and rubbish resulting from the Contract work shall be removed from the building and premises.
- C. At the completion of the work each part of the installation shall be thoroughly cleaned. Strainers, vents, pumps, etc., shall be cleaned of dirt. Temporary replaceable air filters shall be removed, and new replaceable air filters shall be installed after the areas have been cleaned for occupancy. The system shall be operated for a sufficient period to thoroughly remove grease, metal cuttings, and other foreign matter from the system.
- D. Any stoppage or any discoloration or other damage to any part of the building, its finish or furnishings due to the Contractor's failure to properly clean the piping, shall be repaired by the Contractor without cost to the Owner.
- E. The circulating water system piping, steam and condensate piping, circulating pumps, boilers and water passages shall be cleaned as indicated in the following sections:
  - 1. 23 2510 Closed Loop Water Treatment
- F. New equipment installed under this Contract, existing remaining equipment, and new and existing furnishings and finishes soiled or damaged due to the work included under this Contract shall be thoroughly cleaned as required to remove plaster, dust, paint splashes, labels and debris.

### 3.2 INSTRUCTIONS TO OPERATING PERSONNEL

- A. The Contractor and his subcontractors shall satisfactorily complete the systems so that they are functional and operating to the satisfaction of the Architect and Commissioning Agent. The systems, their controls and their sequencing must be demonstrated to the satisfaction of the Architect and Commissioning Agent.
- B. Instruct the Operating Personnel as to the proper care and maintenance of the systems installed under this contract.
- C. The Contractor shall furnish the services of qualified personnel, approved by the Architect and thoroughly familiar with the completed installation to instruct the permanent operating personnel in the proper operation of the systems included under this Contract and the proper care of the equipment and apparatus. These services shall be furnished for a period of five (5) 8-hour days after the operation of the building has been taken over by the Owner.
- D. When instructions are provided under this Contract, the Contractor shall have in his possession three copies of an identifying letter which shall list the names of the Contractor's qualified instruction personnel including manufacturers' representatives and subcontractors that will be giving instructions. Likewise, on the same letter, spaces shall be provided for the Owner's personnel who will receive the instructions. After instructions have been given and received for each system, the Contractor's representatives and subcontractors shall sign and date the letter, and the Owner's personnel shall sign and date the letter acknowledging that they have received adequate instructions for operating and maintaining the systems and equipment. One (1) signed

copy shall be delivered to the Owner, one (1) copy to the Architect, and one (1) copy shall be retained by the Contractor.

- E. In addition to the verbal instructions outlined above, the Contractor and his manufacturers' representatives and subcontractors shall furnish written basic instructions indicating the proper operation of each system and associated equipment. Each manufacturer shall also submit a brochure on his equipment including instructions on operation, lubrication, recommended spare parts, and instructions on preventative, routine, and breakdown maintenance. The brochures and formats must be approved by the Architect.
- F. The Contractor shall combine the written instructions and the manufacturers' equipment brochures in complete volumes with hard back binders which shall be turned over to the Owner before final acceptance of the Contract work. The Contractor shall furnish the Owner with three (3) complete sets of the manuals indexed by equipment and by manufacturer. The Contractor shall obtain two (2) copies of a signed receipt from the Owner for the written instructions and equipment brochures. One (1) copy of the receipt shall be delivered to the Architect and one (1) copy retained by the Contractor.
- G. It is the intent that this entire system with its complement of equipment and auxiliary equipment operate properly in accordance with the design concept and functional intent. It is also the intent that the Owner be given complete instructions for the proper operation and maintenance of the entire system.

### 3.3 RECORD (AS-BUILT) DRAWINGS

- A. The Contractor shall maintain a complete set of Contract Drawings at the site and shall record each deviation in his work (**in red ink or pencil**) from that indicated on the Contract Drawings. Deviations shall be clearly and accurately recorded so that the Engineer can prepare final record (as-built) drawings using the Contractor's marked-up drawings. Dimensions shall be recorded using permanent reference points such as columns, building walls and like items. These record drawings shall be submitted to the Architect prior to final acceptance.

### 3.4 WARRANTY

- A. The Contractor shall warrant that the materials and workmanship used in the erection of this installation are as herein specified, and he shall provide the necessary labor and materials required to make good any defects in same which become apparent within one (1) year from date of acceptance of completed work providing such defects are due to faulty materials or workmanship and not to misuse of apparatus by the Owner, his employees, or tenants. Certain equipment shall be warranted or guaranteed for longer than one (1) year from date of final acceptance where specifically mentioned in these specifications.
- B. The equipment and materials manufacturers are expected to recognize that they are responsible for the failure of their products to perform in accordance with data furnished by them or their authorized representatives as well as misrepresentations of such data. When the products have been installed in accordance with the manufacturer's published or written instructions and recommendations and such products fail, then the Contractor and the manufacturers are responsible for replacement of the products and the associated work and materials without

additional cost to the Owner. This warranty applies to each item supplied on the equipment and not just those that are the product of the manufacturer.

### 3.5 COORDINATION DRAWINGS

#### A. Coordination

1. Each Contractor shall familiarize himself with the drawings and specifications of the other contracts relating to this project and shall coordinate with and be held responsible for his Work which is affected by or dependent on, other contracts.
2. Each Contractor shall provide any dimension, coordination, sleeve, insert, embedded or built-in item, and/or information which is required to be built into, or to complete, the work of another contract in a manner consistent with the Approved Project Schedule. Any additional cost or delay damages arising from a contractor's failure to so furnish or provide shall be borne by that contractor.

#### B. Coordination Drawings and Procedures

1. Each Contractor shall prepare composite shop drawings and field installation layouts for his work as directed by the Architect to solve tight field conditions except as modified in Paragraph 3 below. Such drawings shall consist of dimensioned plans and elevations and shall give complete information, particularly to size and location of sleeves, attachments, openings, conduits, ducts, boxes and structural interferences.
2. These composite shop drawings and field installation layouts shall be coordinated in the field among the Contractors to verify the proper relationship to the work of other Contractors based on field conditions and shall be checked for accuracy and approved by the Contractors as directed by the Architect before submission to the Architect for his final approval.
3. HVAC, Plumbing, Fire Protection and Electrical Work shall be coordinated as indicated by the following procedure. Each Contractor shall sign each coordination drawing after the work has been laid out and conflicts resolved. The preparation of coordination drawings and layout Work on the coordination drawings shall be performed at the site by each Contractor.
  - a. The HVAC Contractor shall prepare a CAD drawing of each area, at a scale of 1/4" inch equal 1'-0", showing his work plan and elevation. The Architect/Engineer can provide CAD Backgrounds of the entire project to the HVAC Contractor for his use. The HVAC Contractor shall layout and show light fixtures on the drawings.
  - b. The CAD Drawings referred to in 3. a. above shall then be forwarded to the next succeeding Contractor for layout of their work in the field in the following order; (a) PLUMBING AND FIRE PROTECTION; (b) ELECTRICAL; (c) INTERIOR CONSTRUCTION.
  - c. By use of color coding and layering each succeeding Contractor shall show his work on the referenced CAD Drawing and shall sign same to indicate his satisfaction that there is no interference between his work and that of other Contractors. Colors will be assigned by the Architect.
  - d. When the work has been shown and signed off, the HVAC Contractor shall forward each CAD Drawings to the Architect, for review and approval. Prints of approved CAD Drawings shall be distributed to the Contractors by the Architect.
  - e. The Architect shall print one copy for each trade for use in the field.

- f. The color coded transparency shall be kept at the Architect's field office for future reference in the event of conflict between the trades. At the completion of the project, all color coded transparencies shall be delivered to the Owner for his records.
- g. No installation work will proceed until EACH contractor has signed off and agreed to the coordination drawings.

C. Meetings

- 1. Coordination meetings to resolve interferences in the Work will be held at the site in an area to be provided by the Architect. Representatives of each Contractor shall be present at each meeting. Each Contractor shall provide the necessary resources to insure, that the coordination process described herein does not delay the Approved Project Schedule.

- D. Each Contractor acknowledges that there may be items of Work which have not been drawn, coordinated, clarified or specified with complete detail in the Contract Documents but which are required for the completion of the Work, as inferable from the Contractor Documents. Any such item, when identified as part of the development of the Work, shall be drawn, coordinated, clarified or specified by the Architect in a manner consistent with contemplated kind, quality and customary standards and provided to the Contractor. When such drawing, coordination, clarification or specification is approved by the Owner, the drawing, coordination, clarification or specification so approved shall thereupon be part of the Contract Documents and the item of Work shall be performed by the Contractor as part of the Work without further action or order of the Owner and without any increase in the Contract amount or time as if such drawing, coordination, clarification or specification were originally included in the Contract Documents.

3.6 MERCURY PROHIBITION

- A. The use of mercury as a component of any equipment installed as part of this work is strictly prohibited. Where required, mercury substitutes shall be used in thermometers, thermostats, switches, and other equipment, which might commonly contain mercury.

END OF SECTION 230506

### Submittal Log (Attachment A)

Project Name: \_\_\_\_\_

CJL Project No.: \_\_\_\_\_ Trade: \_\_\_\_\_

Engineer's Review: A = Reviewed, B = Rejected, C = Furnish as Corrected, D = Comments Attached

Contractor's Required Response: E = Confirm, F = Resubmit

No.	Specification Number	Description	Manufacturer	Date Received	Action Taken	Date Returned
	23 0506	O&M Manuals				
	23 0506	As-Built Drawings				
	23 0519	Piping Specialties - HVAC				
	23 0523	HVAC Valves				
	23 0529	Hangers and Supports - HVAC				
	23 0553	Equipment & Piping Identification - HVAC				
	23 0593	Testing, Adjusting, and Balancing of Systems (TAB Reports)				
	23 0700	HVAC Insulation				
	23 0900	Instrumentation and Control				
	23 0993	Sequence of Operation				
	23 2113	HVAC Piping				
	23 2123	HVAC Pumps and Accessories				
	23 2510	Closed Loop Water Treatment				
	23 3113	Ductwork				
	23 3300	Ductwork Accessories				



**Submittal Log (Attachment A)**

**Project Name:** \_\_\_\_\_

**CJL Project No.:** \_\_\_\_\_ **Trade:** \_\_\_\_\_

Engineer's Review: A = Reviewed, B = Rejected, C = Furnish as Corrected, D = Comments Attached

Contractor's Required Response: E = Confirm, F = Resubmit

No.	Specification Number	Description	Manufacturer	Date Received	Action Taken	Date Returned
	23 3423	Exhaust Fans				
	23 3424	Roof Mounted Equipment Accessories				
	23 3433	Air Curtains				
	23 3600	Variable & Constant Volume Boxes				
	23 3713	Air Outlets & Inlets				
	23 5233	Boiler-Wall Hung				
	23 7300	Packaged Roof Top Units				
	23 8127	In-Ceiling Cassette Air Conditioner – Heat Pump				
	23 8213	Terminal Heating-Cooling Units				
	23 8316	Radiant Heating System				

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## SECTION 230511 – RESTORATION AND RETROFIT - HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 WORK IN PRESENT BUILDING

- A. This work shall be coordinated with the work of other trades and shall be performed in accordance with the Schedule of Work of the as required by the Architect and the Owner. The Contractor shall review the phasing schedule and comply with sections of this schedule.
- B. The General Contractor will remodel the Present Building in areas shown on the Drawings in accordance with a specific schedule. The HVAC Contractor shall refer to the Construction drawings to determine the extent of the remodeling in each area. The HVAC Contractor shall disconnect and remove existing equipment no longer required and furnish and install new equipment as shown, herein specified and as required to form complete, new systems. Equipment shall include some existing heating equipment, exhaust systems and piping as shown and noted.
- C. The Contractor shall visit the site to determine exact locations, sizes and quantities of present equipment and ductwork which must be removed. The HVAC Contractor will be held responsible for the disconnection and removal of existing heating and ventilating systems as noted and the installation of all new piping, ductwork and equipment complete in every detail and in accordance with the phasing schedule. The Contractor shall provide "Demolition/Renovation Notification" as required by the State Department of Environmental Resources, Bureau of Air Quality Control.
- D. Existing ductwork, piping and conduit for the heating system no longer required and concealed in walls, pipe tunnels, crawl spaces or above fixed ceilings and not interfering with new construction or remodeled work may remain and shall be capped, abandoned and rendered "dead."
- E. The Contractor shall arrange the new hangers and supports so that new pipe lines and other equipment are not suspended from the same joists and structural members as present lines and equipment. Hangers and supports shall be arranged to distribute the weight of the new lines and equipment uniformly on the present structure. Additional new structural members shall be furnished and installed as necessary to safely support the new lines and equipment.
- F. Generally, the existing ceilings will be replaced throughout the Present Building in the remodeled areas. New ductwork, piping, etc., shall be concealed above the new and existing ceilings. As noted, and shown, only piping and ductwork noted as below ceiling can remain exposed.

- G. At certain locations, existing ductwork and equipment shall be disconnected and removed, and new piping, ductwork, and equipment shall be furnished and installed under this contract above existing ceilings. The HVAC Contractor will be responsible for restoring the existing ceilings to their present condition where they are removed or damaged by the work included under this Contract, and when the ceilings are not being replaced with new ceilings by the General Contractor. The HVAC Contractor shall also be responsible for repair work to the existing ceilings, as required to maintain the fire rating of the existing ceiling.
- H. The Contractor shall clean up the areas as the work progresses and thoroughly remove waste and debris daily or when directed.
- I. The Contractor shall perform the cutting and patching required for the installation of new piping, ductwork, and equipment, and for the removal of present equipment as herein specified. The HVAC Contractor shall be responsible for maintaining the structural integrity of the Existing Building where areas such as load bearing walls, and floor construction are patched and repaired under this Contract. The patching shall be done subject to the approval of the Architect. The HVAC Contractor will be responsible for entrance of the new equipment into the building, and for the removal of existing equipment from the building, and for the cutting, patching and repairing of existing construction.
- J. Existing removed unit heaters, fans and other similar useful equipment and materials tagged by the Owner shall remain the property of the Owner and shall be stored at the site where directed by the Owner and Architect. Equipment shall be stored as complete units with the associated accessories and auxiliary equipment. Equipment shall be disconnected and carefully removed under this Contract and shall be transported to the storage areas as directed. Equipment shall be stored in a neat and workmanlike manner, tagged and identified for future use.
- K. Removed piping, fittings, hangers, ducts, grilles and other miscellaneous materials and equipment no longer required, shall not be reused as a part of the new installation, but shall become the property of the Contractor and shall be immediately removed from the site. The HVAC Contractor shall give due consideration and credit in his proposal for present materials and equipment which will become his property. Existing removed equipment remaining the property of the Contractor shall be dismantled and cut in sections as required for removal from building.
- L. The Contractor shall provide and later remove temporary HVAC services and equipment as required to keep systems operating during construction. The Contractor shall maintain acceptable temperatures in construction-impacted spaces where Owner operations, functions and services continue to be provided.

### 1.3 REMOVAL AND DISPOSAL OF HEALTH HAZARDOUS MATERIALS

- A. This Contractor shall immediately report the presence of any asbestos to the Architect. No asbestos removal is to be included under this Contract.

### 1.4 CUTTING AND PATCHING

- A. The Contractor shall perform the cutting and patching for the removal of existing piping, ductwork and equipment and the installation of new piping, ductwork and equipment in the Existing Building.

- B. New openings in walls, floors, and partitions for pipe lines, ducts, hangers, supports, and other equipment in the Existing Building shall be provided by this Contractor for the new and remodeled installation. New openings in existing construction and the repair of such openings for the entrance of new heating, ventilating and air conditioning equipment into the building or for the removal of existing heating and ventilating equipment from the building shall be included in the HVAC Contract. Openings in existing exterior walls shall be cut by the HVAC Contractor. Openings in existing roofs shall be the responsibility of this Contractor. Final roofing shall be done by the Roofing Contractor as called out in the Architect's Front End Specifications.
- C. Wherever it becomes necessary to cut out any portions of walls, floors, ceilings, or other portions of the building as may be required to perform the work under this Contract, the Contractor shall perform the necessary cutting and fitting, shall remove the excess material, and shall replace damaged work so as to leave the premises in a finished condition. No cutting shall be done which may in any way affect the building structurally or architecturally without first securing the consent and approval of the Architect. Any damage incident to cutting or other causes in the performance of this Contract shall be made good by replacement or repairs in a manner satisfactory to the Architect. The Contractor must use extra precaution so as not to disturb the bearing quality of existing walls or other construction.
- D. HVAC Contractor shall furnish openings in existing walls and roof for intake and outlets. This Contractor shall coordinate location and site. Openings in existing roofs shall be the responsibility of this Contractor. Final roofing shall be by the General Contractor.
- E. Where present equipment is removed, and unused openings remain in walls, floors, partitions, etc., the HVAC Contractor shall properly patch such openings to match their immediate surroundings unless specifically shown to be included under the General Contractor's scope of work.
- F. Patching and repairing shall be done by workmen skilled in this type of work and shall match present or new finishes.
- G. Cutting performed under this Contract shall be done in a neat and workmanlike manner. The size of each new opening shall be kept to minimum size. The location of each new opening must be approved by the Architect before the opening is drilled or cut.
- H. Where existing ceilings and walls and similar construction are penetrated for the installation of new hangers, supports, and other equipment, the Contractor shall repair the openings with fireproof materials to maintain the fire rating of the ceiling or wall construction, or similar construction.
- I. The Contractor's attention is directed to the Architectural Drawings to determine areas in which the other contractors will perform extensive remodeling work. Cutting and patching shall be directly coordinated with remodeling work performed by other contractors. This Contractor shall cooperate with the other contractors in every manner in making the installations.
- J. Patching and repairing shall be done to match present construction and finishes in materials, color, and texture. Cutting, patching, repairing, and painting shall be performed by workmen skilled in that type of work. Patching shall be completed to a neat, finished condition. Where the General Contractor applies new finishes, except painting, on existing walls, floors, ceilings, and similar locations, it will not be necessary for the HVAC Contractor to apply finished patching or painting to the remodeled surfaces; however, the Contractor shall rough patch the

areas for the final finish. Where the existing area is to be repainted by the Painting Contractor, the HVAC Contractor must repair his openings and provide a prime coat and one finish coat of paint to be ready for the Painting Contractor's final coat of paint. The Contractor's attention is directed to the Architect's Construction Drawings to determine exact locations where new finishes on walls, floors, ceilings, and similar locations will be provided under separate Contract. The HVAC Contractor shall repair and finish all openings where the other Contractors are not providing new finishes. When providing final painting of patched areas, entire wall or ceiling shall be painted corner to corner and top to bottom so that the entire wall or ceiling is painted. Painting of existing walls or ceilings will not be necessary unless the walls or ceilings are patched and repaired under this Contract.

#### 1.5 DUST, DIRT, AND NOISE

- A. The Contractor shall perform cutting and patching and shall make modifications, relocations, and installations with a minimum of noise.
- B. Existing and new equipment, floors, walls, etc., shall be adequately protected from dust and dirt caused by the work. Protection shall include suitable temporary barriers or coverings. The exterior and interior premises of the building shall be kept as clean as possible during construction. At no time shall the Contractor interfere with the normal operation of the facility by allowing debris, etc., to remain on the premises. Contractor shall use industrial type vacuum cleaners for removal of plaster, dust, etc. in each area of the building included in his scope of work.

#### 1.6 SCHEDULE OF WORK AND CONTINUITY OF SERVICE

- A. It is the Owner's desire to maintain the operation of the existing building with a minimum of disruption; therefore, the Contractor shall closely coordinate the scheduling of his work as well as equipment deliveries with the Schedule of Work prepared by the Architect. The schedule of work may be revised periodically during the course of construction, but each revised schedule must be approved by the Architect.
- B. When it becomes necessary to interrupt any part of the operation of the HVAC system, the Contractor shall notify the Architect and Owner 48 hours in advance of the proposed interruption. The HVAC system shall only be interrupted when absolutely necessary and at a time to conform to the Owner's schedule.
- C. Long interruptions of the HVAC system, due to faulty workmanship or improper scheduling of work will not be tolerated. The building must remain in use.

### PART 2 - PRODUCTS

#### 2.1 NOT APPLICABLE TO THIS SECTION

### PART 3 – EXECUTION

3.1 NOT APPLICABLE TO THIS SECTION

END OF SECTION 230511

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## SECTION 230519 – PIPING SPECIALTIES – HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The piping specialties for the various HVAC systems shall be as hereinafter described in this section.

### PART 2 - PRODUCTS

#### 2.1 GAUGES AND THERMOMETERS

- A. Furnish and install all pressure gauges and thermometers as herein specified. All pressure gauges shall be calibrated at the site by the Contractor at the same point of connection. Separable wells shall be installed by the Heating Contractor at each location.
- B. Pressure gauges shall be 4½" diameter and adjustable to zero to compensate for static water pressure. Gauge dial ranges on the water systems shall be graduated 0 to 100 psi with 10 psi figure intervals and 1 psi graduation, for the water system. Accuracy of each gauge shall be ½ of 1% over entire scale range. Cases shall be cast aluminum with black finish and chrome ring. Pressure gauges shall be of the bronze bourdon tube type with 4½" diameter dials similar to the 500X Series, each with No. 872-2 pressure snubber, and No. 735-2 needle valve as manufactured by Trerice, Ashcroft, Weksler, Miljoco or approved equal.
- C. Thermometers shall have 9" scales, adjustable angle non- mercury thermometer with "A" Series brass stem. Range for hot water lines and equipment shall be 30 degrees F. to 300 degrees F. Thermometers shall each have a stainless steel front with glass cover and shall be provided with a suitable stainless steel separable socket. Thermometers shall be the BX Series, adjustable angle type, as manufactured by Trerice, Ashcroft, Miljoco or approved equal.
- D. Stem lengths shall range between 30% and 50% of inside diameter of piping, and wells shall be arranged to accommodate stems.
- E. Thermometers and gauges shall be installed in a manner that will allow them to be easily read from the operating floor.

- F. In lieu of installing a multiple number of pressure gauges at circulating pumps, the Contractor shall have the option of installing one (1) pressure gauge of type herein specified mounted on a multiple port manifold valve constructed of brass and suitable for 175 psig working pressure. Manifold valve shall be furnished with spring return pushbutton ports with 1/4" O.D. compression unions, mounting bracket and capped test port connection for gauge calibration. Furnish and install Type L 1/4" O.D. copper tubing with flared connections from manifold valve ports to locations on pump casing and piping where pressure gauges would normally be installed, generally where indicated on the Drawings. Furnish and install screwed connectors, compression union and shut-off valve at each connection to piping or pump casing. Copper tubing shall be installed in a neat workmanlike manner and shall be properly supported. Manifold valves shall be mounted on system piping at convenient location to permit easy access for pushbutton operation and pressure gauge observation. The manifold valve shall be as manufactured by Flow Conditioning Corp. or approved equal.

## 2.2 PRESSURE TAPS

- A. At locations shown on the Drawings, the Contractor shall furnish and install combination pressure and temperature taps on supply and return lines at all terminal equipment and at other locations indicated on the Drawings. Pressure and temperature taps at each location shall consist of a 1/4" NPT fitting to receive either a temperature or a pressure probe 1/8" O.D. The fitting shall be solid brass with two (2) self-closing valve core of Nordel suitable for a temperature of 275 degrees F. and pressure rating of 1,000 psig, fitted with a yellow color-coded and marked cap with gasket. Fitting shall be the "Pete's Plug" Model 110XL, as manufactured by the Peterson Equipment Co., Inc. or approved equal. Fitting shall be capable of passing a no-leakage test by a recognized testing laboratory for a minimum of 80 insertions during a five (5) day period at a pressure of 100 psig and temperature of 240 degrees F.
- B. Furnish and deliver to the Owner, a separate Test Kit consisting of a 0-200 psi, 0-230 foot of water pressure gauge with a 1/8 inch O.D. gauge adapter attached, a 0 degree F. to 220 degrees F. pocket testing thermometer, and a protective carrying case. The Contractor shall also supply the Owner with two (2) additional pressure gauge adapters (Model 500XL) with 1/8" O.D. probe and four (4) five inch (5") stem pocket testing thermometers graduated 0 degrees to 220 degrees F. All of the above components shall be as manufactured by Peterson Equipment Co., Inc., or approved equal.

## 2.3 ELECTROLYSIS CONTROL

- A. All copper tubing installed or connected under this Contract shall be installed in such a manner that the tubing will not touch or come in contact in any way with ferrous metals. Where copper tubing, piping or fittings are anchored, guided, supported or may come in contact with ferrous metal construction, an insulating nonconductor spacer, similar to rubber or fiber, shall be installed to assure prevention of electrolysis.
- B. Copper tubing lines shall not be (even temporarily) supported or secured to ferrous metals. When copper tubing or piping is connected to ferrous piping or equipment, connections shall be made with dielectric unions, couplings or fittings, as manufactured by Epco Sales, Inc., Walter Vallett Company, Watts Regulator Co., Clear-Flow, or approved equal.

2.4 EXPANSION TANKS

- A. Furnish and install ASME constructed and equipped expansion tanks as indicated for the hot and chilled water system. Tanks shall be supported with rod and angle supports and concrete base.
- B. Tanks shall be furnished with necessary tappings and shall be equipped with gauge glass, air charging type hose and drain valve, and air control fitting and, where required, air vent tube. The tank supply line from the system shall be fitted with a gate type shut-off valve to facilitate draining the tank individually. Expansion tanks shall be Extrol diaphragm type or approved equivalent.
- C. Tanks shall be pre-charged to pressure indicated on Drawings. The installation must conform with the requirements of the State Department of Labor and Industry, including the installation of a relief valve.

2.5 AIR ELIMINATOR AND DIRT SEPARATOR

- A. Acceptable Manufacturer:
  - 1. Bell & Gossett CRS (Basis of Design)
  - 2. Spirovent by Spirotherm
  - 3. Peerless
  - 4. Armstrong
  - 5. Taco
  - 6. Wessels Company
  - 7. American Wheatley
- B. Furnish and install as shown on the drawings a coalescing type air eliminator and dirt separator on the hot and chilled water systems.
- C. Pipe size is not a factor and all units should be selected at the point of peak efficiency per the manufacturer's recommendations.
- D. All combination units shall be fabricated steel, rated for 150 psig working pressure with entering velocities not to exceed 4 feet per second at specified GPM.
- E. Units specifically designed for high velocity systems may have an entering velocity of up to 10 feet per second.
- F. Units shall include an internal bundle filling the entire vessel to suppress turbulence and provide high efficiency. The bundle must consist of a copper core tube with continuous wound copper medium permanently affixed to the core. A separate copper medium is to be wound completely around and permanently affixed to the internal element.
- G. Each eliminator shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism.

- H. Units shall include a valved side tap to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill.
- I. Separator shall have the vessel extended below the pipe connections an equal distance for dirt separation.
- J. Separator shall include a removable lower head to facilitate removal of internal assembly for inspection or cleaning. Separators shall be capable of removing 100% of the free air, 100% of the entrained air, and up to 99.6% of the dissolved air in the system fluid. Dirt separation shall be at least 80% of all particles 30 micron and larger within 100 passes.

## 2.6 CHEMICAL FEEDER (ONE SHOT TYPE)

- A. Furnish and install on the hot and chilled water piping system, where shown, a "One-Shot" chemical feeder. Feeder shall be complete with tank, wide mouth opening, shutoff valves, drain valve, flow indicator, and nipples.
- B. Feeder shall have a capacity of 2-1/2 gallons and shall be the Model M-20 as manufactured by the North American Mogul Products Company, Culligan, Clow, or approved equal, and shall be installed in strict accordance with the manufacturer's recommendations.
- C. The Contractor shall have a chemical analysis made of the heating system water, cooling system water and raw building water. Water analysis shall be made after complete system has been cleaned. Two (2) copies of each water analysis along with two (2) copies of the treatment recommended, shall be furnished, one (1) copy delivered to the Owner and one (1) copy delivered to the Architect. The analysis shall be made by the approved feeder supplier.
- D. Chemicals for the initial filling of the system shall be purchased by the Contractor. All chemical containers shall be marked with the chemical name and appropriate hazard warnings as required by OSHA 29, CFR 1910.1200.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install all equipment per manufacturers recommendation and Best Industry Standards.

END OF SECTION 230519

## SECTION 23 0523 – HVAC VALVES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The valves for the various HVAC systems shall be as hereinafter described in this section.

#### 1.3 SUBMITTALS

- A. Provide data sheets for each valve type and accessory to be included on this project.
- B. Submitted valves and accessories shall conform to the specifications, including materials, sizes and styles.

### PART 2 - PRODUCTS

#### 2.1 VALVES AND ACCESSORIES – CIRCULATING WATER SERVICE

- A. Circulating Water Service shall include the following:
  - 1. Hot Water Supply and Return (HWS & R)
  - 2. Domestic Cold Water Make-Up
  - 3. Associated drain, relief and vent piping
- B. General Requirements:
  - 1. Furnish and install all valves and piping system accessories indicated on the Drawings or as required for proper operation of the systems.
  - 2. Unless otherwise specified, valve numbers in the Specifications are taken from the catalog of NIBCO Inc. and are intended to denote a standard of quality and type required. Comparable valves of other manufacturers, such as Milwaukee, Hammond, Apollo, Crane, Jamesbury, Neles, Victaulic or approved equivalent will be acceptable.
  - 3. All valves shall be of one manufacturer, except where specified otherwise.
  - 4. **Apollo International is not acceptable.**
  - 5. In general, ball valves and butterfly valves shall be used on water lines where the service requires valves to be wide open or tightly closed.
  - 6. Plug valves shall be used where services require valves to be throttled.

7. Valves in Mechanical Equipment Rooms shall be provided with chain operators to make valves accessible from the floor where valves are located out-of-reach of operating personnel, 7'-0" feet in height or higher.
8. All valves, except where specified otherwise, shall be suitable for at least 200 PSI minimum water working pressure, Class 125. All valves, except on small threaded or soldered lines, shall be flanged.
9. Bronze valves, including bronze check valves, shall be made to be "dezincification resistant", with metal components in the waterway not containing more than 15% zinc in their chemical makeup.

C. Gate Valves:

1. Gate valves 2" and smaller shall be bronze body, bronze-mounted, threaded pattern, solid wedge, inside screw, rising stem; solder pattern for copper lines.
2. Valves 2½" and larger shall be iron body, bronze-mounted, flanged, OS&Y pattern.
3. Iron body valves shall be suitable for 125 PSI SWP, Figure No. F-617-0.
4. Bronze body valves shall be suitable for a minimum of 125 PSI SWP, Figure No. T-111.
5. Valves on copper tubing water lines shall be suitable for a minimum of 125 PSI SWP and shall be solder end type, Figure No. S-111.

D. Ball Valves:

1. Ball valves shall be installed on all water service lines 2" and smaller and shall be two-piece bronze body, stainless steel stem and ball, with a conventional port, reinforced TFE packing (no "O" ring), with insulated operator, 600 PSIG CWP.
2. Ball valves shall be suitable for -40°F. to 350°F.
3. Ball valves shall be NIBCO No. T-585-70-66-NS (NIB-SEAL Handle) for threaded ends and NIBCO No. S-585-70-66-NS for soldered ends, or approved equivalent.

E. Butterfly Valves:

1. Butterfly valves shall be BOS-US, uninterrupted seat, offset disc, resilient seated, as manufactured by DeZurik, 815 Series as manufactured by Jamesbury, or Vic®-300 MasterSeal™ series as manufactured by Victaulic.
2. Butterfly valves shall be furnished and installed on all water lines 2-1/2" and larger. Valves shall be guaranteed for zero-leakage bi-directional shut-off, complete with manual infinite throttling handle and position indicator, and suitable for dead-end service.
3. Valves shall be suitable for 200 PSI CWP, shall be complete with EPDM seat and shaft seals suitable for high temperature (250°F.) service, aluminum bronze bearings, 316 SS discs, lug type ductile iron body, and 316 SS stem.
4. Bodies shall be furnished with tapped lugs and flange bolts or grooved fittings to allow downstream piping to be disconnected, leaving the valve in line to control the flow.
5. Bolts shall be installed at each side of the lugs to allow downstream piping to be disconnected.
6. Butterfly valves 4" and smaller shall be furnished with a hand lever operator.
7. Butterfly valves 6" and larger shall be furnished with a quarter turn gear operator with hand wheel.
8. All valves shall be furnished with a disc position/over-travel indicator to provide visual indication of disc position and to simplify actuator adjustment.

F. Globe Valves:

1. Globe valves 2" and smaller shall be bronze body, bronze-mounted, threaded pattern, solid wedge, inside screw, rising stem; solder pattern for copper lines.
2. Valves 2½" and larger shall be iron body, bronze-mounted, flanged, OS&Y pattern.
3. Iron body valves shall be suitable for 125 PSI SWP, Figure No. Figure No. F-718-B.
4. Bronze body valves shall be suitable for a minimum of 125 PSI SWP, Figure No. Figure No. T-211 or angle valve T-311-Y.
5. Valves on copper tubing water lines shall be suitable for a minimum of 125 PSI SWP and shall be solder end type, Figure No. Figure No. S-211 or angle valve S-311-Y.

G. Plug Valves:

1. Plug valves at locations on water mains, isolation valve stations, pumps, and on water piping 2½" and larger at terminal equipment, shall be the gland-packed type, complete with resilient facing, suitable to 250°F., similar to DeZurik Series 100, Keystone "Ballcentric", or approved equivalent.
2. Plug valves 2" and smaller shall be DeZurik Figure 120, Keystone "Ballcentric", or approved equivalent, suitable for 175 PSI WWP and shall be provided with bronze bodies, screwed ends, stainless steel bearings, and resilient plugs.
3. Plug valves 2½" and larger shall be DeZurik Figure 118, Keystone "Ballcentric", suitable for 175 PSI WWP and shall be provided with cast iron bodies, nickel seats, flanged ends, and resilient plugs.

H. Manual Balancing Valves:

1. Furnish and install one manual balancing valve at all water terminal equipment coils on 2" and smaller return piping.
2. Valves shall be suitable for combined indicating, balancing, and tight shut-off. Valves shall be the Circuit Setter Plus by Bell and Gossett, Quick Set by Griswold Controls, the UltraXB Orturi Model XB by Nexus, Model TBV by IMI, ACCU FLO by Taco, TA Series 786/787/788/789 and 78K by Victaulic / Tour Anderson, or NIBCO styles 1810, F737A, and G737.
3. Valves shall be suitable for 300 PSI water pressure, 250°F. total temperature, and shall have full turn balancing device, lockable in any position.
4. Valves shall be equipped with a visible indicating dial with screwdriver adjustment.
5. Valves shall be re-packable under pressure.
6. Balancing valves 4" and smaller shall be furnished with a hand lever operator.
7. Balancing valves 6" and larger shall be furnished with a quarter turn gear operator with hand wheel.
8. All balancing valves shall be furnished with a disc position/ over-travel indicator to provide visual indication of disc position and to simplify actuator adjustment.

I. Check Valves (Pump Discharge, Surge, & Water Hammer):

1. Check valves at all pumps and on water piping 2½" and larger shall be of type that controls surge pressures and resulting water hammer.
2. Valves shall be iron body, flanged, with bronze trim.
3. Check valves shall be "Silent Check Valves", the Nibco No. F-910-B-LF, Metraflex Company, Techno Corp., or approved equivalent.

J. Check Valves:

1. Check Valves 2" and smaller shall be bronze body, horizontal swing, regrinding type, Y-pattern, renewable seat and disc, threaded ends, or solder ends for copper lines.
2. Bronze body valves shall be suitable for a minimum of 125 PSI SWP, Figure No. T-413-B.
3. Valves on copper tubing water lines shall be suitable for a minimum of 125 PSI SWP, Figure No. S-413.

K. Strainers:

1. Furnish and install Y-type strainers. Baskets in strainers shall be stainless steel, 2" and smaller shall be No. 20 mesh, and 2½" and larger shall have 1/8" diameter perforations.
2. Each strainer shall have a full size gate valve on the blowdown drain connection with drain line extended to funnel
3. Valves, nipples and strainer baskets shall be readily removable.
4. Strainers 2" and smaller shall be bronze body, screwed or sweat ends as required, Spirax Sarco Type BT or TBT, Armstrong, Watts, or approved equivalent.
5. Strainers 2½" and larger shall be cast iron body, flanged, Spirax Sarco Type CI-125 or F-125, Armstrong Type A1FL-125, Watts, or approved equivalent.

L. Safety Relief Valves:

1. Safety relief valves shall be installed on water piping as required by local regulatory agencies having jurisdiction.
2. Safety relief valves shall serve the dual purpose of relieving over-pressure created by thermal expansion and over-pressure in the form of water.
3. Safety relief valves shall be ASME rated and shall be similar to Watts Series 174A and 740, Kunkle, Conbraco, or approved equivalent.
4. Discharge of safety relief valves shall be piped to funnel drains or floor drains.
5. All safety relief valves shall be ASME approved and certified by the National Board of Boiler and Pressure Vessel Inspectors and shall bear approval stamps, along with pressure and capacity data.

M. Manual Air Vents:

1. On all high point of water mains and on coils and other heating terminals furnish and install a ¼" manual air vent with full sized gate valve. Air vent outlets shall be extended to accessible locations. Air vent outlets shall terminate over funnel or floor drains where possible. Where necessary, hose end adapters shall be provided on vent piping.
2. Furnish and install on high point of each coil in each cabinet unit heater, and radiant panel, one manual air vent similar to Dole No. 14, or approved equivalent. Vents shall be connected to coil vent taps and extended to an accessible location in each cabinet. Vent tubing shall be coiled, and outlet extended to a point near access door. All tubing within the cabinets shall be securely anchored.

N. Automatic Air Vents:

1. Furnish and install on each horizontal delivery propeller type hot water unit heater, one automatic float type air vent, similar to Hoffman No. 79, or approved equivalent. Provide cock at each vent. Vents shall be suitable for 75 PSIG operating pressure.



2. Automatic air vents on lines at locations shown shall be the Armstrong No. 1-AV with petcock, Spirax Sarco No. 13WS, Apco No. 50, or approved equivalent. Air vents shall have 150 PSI cast bodies and stainless steel trim.

O. Drain Valves:

1. All low points of the piping system shall be provided with drain valves so that the complete system can be drained.
2. Each down fed unit or other equipment shall be provided with drain valves.
3. Drain valves shall be ½" with hose end and cap similar to NIBCO No. T-585-70-66-HC or S-585-70-66-HC, or approved equivalent.

P. Unions:

1. Unions shall be 300 lb. WOG, malleable iron ground joint type, with bronze-to-iron seat, Class 150, Grinnell Fig. No. 463, or approved equivalent.

Q. Grooved End Valves:

1. Butterfly Valves:

- a. Grooved end butterfly valves shall be furnished and installed on all water lines 2" and larger utilizing a grooved piping system.
- b. Valves shall be suitable for bi-directional, dead-end, and bubble-tight shut off at full rated pressure.
- c. Grooved end butterfly valves shall be as manufactured by Victaulic as follows:
- d. 2" through 12": Ductile iron body, electroless nickel or polyamide coated, ductile iron disc, blowout-proof 416 stainless steel stem. Disc shall be offset from the stem centerline to provide full 360 °° seating. EPDM pressure responsive seat and seal material, TFE lined fiberglass bearings, lever handle or gear operator with handwheel and memory stop feature, 300 PSI, grooved ends designed for installation with Victaulic standard couplings. Victaulic Vic®-300 MasterSeal™ or NIBCO GD-4765 Series.
- e. 14" through 24": Polyphenylene Sulfide (PPS) coated ductile iron body and disc, 17-4 PH stainless steel stem design, EPDM seal, reinforced PTFE bearings, gear operator with handwheel and memory stop feature, 300 PSI, AGS grooved ends designed for installation with Victaulic "W" series couplings. Disc shall be offset from the stem centerline to provide full 360 degree seating. Victaulic Vic®-300 AGS.
- f. Butterfly Valves on copper tubing water lines 2½" Inch through 6 Inch shall be grooved end type, Victaulic Butterfly Series 608N.

2. Check Valves:

- a. Check valves at all pumps and on water piping 2" and larger utilizing a grooved piping system shall be spring-assisted, "Silent Check Valves" as manufactured by Victaulic, as follows:
- b. 2" through 3": Ductile iron body, stainless steel disc and spring, brass shaft, nickel-plated seat and grooved ends, 365 PSIG CWP. Victaulic Series 716H.

- c. 4" through 12": Ductile iron body, elastomer encapsulated ductile iron disc, stainless steel spring and shaft, welded-in nickel seat, grooved ends, 300 PSIG CWP. Victaulic Series 716.
  - d. 14" through 24": Ductile iron body, 304 stainless steel dual disc design, stainless steel spring and shaft, EPDM seat bonded to the valve body, AGS grooved ends, 230 PSIG CWP. Victaulic Series W715.
3. Strainers:
- a. Furnish and install grooved end strainers on water systems 2-1/2" and larger utilizing a grooved piping system.
  - b. Y-Type, 2" through 18": Ductile iron body, Type 304 stainless steel perforated metal removable baskets with [0.062"] [0.125"] [0.156"] diameter perforations, blow down port with off-centered pipe plug, 300 PSIG CWP. Victaulic Series 732 and W732.
  - c. T-Type, 2" through 12": Ductile iron body, Type 304 stainless steel mesh removable basket, no. 12 or no. 6 mesh, 57% free open area, removable access coupling and cap for strainer maintenance. Victaulic Series 730.
  - d. T-Type, 14" through 24": Carbon steel body, Type 304 stainless steel mesh removable basket, no. 6 or no. 4 mesh, 57% free open area, carbon steel t-bolt hinged closure/cap for strainer maintenance, AGS grooved ends. Victaulic Series W730.

## 2.2 OTHER VALVES AND ACCESSORIES

### A. Gas Service Valves:

- 1. Valves on gas lines 2" and smaller shall be the NIBCO No. T-580-70-UL or T-585-70-UL, or approved equivalent.
- 2. Valve shall be suitable for natural gas use, UL listed, bronze body, bronze ball, threaded ends, and with blowout-proof stem.
- 3. Valve shall be rated at 600 PSIG WOG.
- 4. Valves on gas lines 2-1/2" and larger shall be the lubricated plug type, gray iron construction, flanged pattern, and shall be the Rockwell-Nordstrom No. 115, or approved equivalent.
- 5. Furnish suitable valve wrenches

### B. Pressure Reducing Valves (for Domestic Cold Water Make-Up):

- 1. Furnish and install on domestic cold water makeup piping to the circulating water system, and/or steam system, water pressure reducing valves similar to the Watts Model U5B or approved equivalent, as required to provide automatic filling of the systems.
- 2. Pressure reducing valves shall each be suitable for 200 PSI WWP, with cast bronze body and bronze trim, sizes shown on the Drawings, but not less than 3/4" size.
- 3. Pressure reducing valves shall be set at pressure indicated on the Drawings.
- 4. The Heating Contractor shall connect to cold water outlet provided by the Plumbing Contractor.

### C. Double Check Valve Assemblies (for Domestic Cold Water Make-Up):

1. Double check valve assemblies on domestic cold water make-up piping shall be Watts Series LF007, or approved equivalent.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Install valves as described above and per manufacturer recommendations.
- B. Grooved Joints:
  1. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions.
  2. Grooved ends shall be clean and free from indentations, projections, and roll marks.
  3. Gaskets shall be molded and produced by the coupling manufacturer and shall be verified as suitable for the intended service.
  4. A factory-trained field representative (direct employee) of the mechanical joint manufacture shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products.
  5. The factory-trained representative shall periodically review the product installation and ensure best practices are being followed.
  6. A distributor's representative is not considered qualified to conduct the training.
  7. Contractor shall remove and replace any improperly installed products.

END OF SECTION 230523

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## SECTION 230529 – PIPE HANGERS AND SUPPORTS - HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The hangers and supports for the various HVAC systems shall be as hereinafter described in this section.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. All piping shall be supported from the building construction by the use of fixed or adjustable beam clamps, concrete inserts, welded structural attachments, lag bolts and lag screws from wood construction, brackets, extension rods, adjustable band ring pipe hangers, or other equipment as dictated by the type of building construction.
- B. Furnish and install all structural steel members for the support of the piping, and equipment to suit the structural and vibration isolation conditions.
- C. Hangers and supports shall be arranged to distribute the weight of the piping and equipment uniformly on the Building structure.
- D. All necessary structural supports and inserts to hang all piping and equipment shall be provided by this Contractor. Hanger rods shall be securely attached to plates. Where cutting is required for the installation of hangers, piping and supports, all openings must be neatly drilled by the Heating Contractor. Punching or chipping of concrete will not be permitted. All necessary openings shall be drilled in a location and manner satisfactory to the Architect. All concrete damaged by the Heating Contractor shall be patched, reinforced or replaced as directed by the Architect. Location of all holes, openings and sleeves shall clear reinforcing steel in floor and roof decks. The Heating Contractor shall coordinate all work with the Architect and shall determine exact locations of all supports, especially for those for vibration isolation, and openings,
- E. Insulation shall be installed over band hangers and all openings shall be sealed as hereinafter specified.
- F. Piping shall only be supported by code approved and manufacturer recommended hanger systems connected directly to the building's structure.

- G. The Contractor shall support piping mains as required in accordance with these specifications.

## 2.2 HANGERS FOR STEEL PIPE

- A. Hangers for all steel piping shall be complete with band hangers, turnbuckles, and rods. Hanger bands shall be flat and suitable for application of insulation over the hanger and pipe.
- B. Acceptable Manufacturers:
1. Basic-PSA, Model BE 124, BE124-1, BE 124-2, BE 124A-1, & BE 124A-2
  2. Modern Pipe Supports Corp., Figure 87
  3. Anvil International, Figure 295
  4. Approved Equal.

## 2.3 HANGERS FOR COPPER PIPE

- A. Hangers for all copper piping shall be complete with all-copper band hangers, turnbuckles, and rods. Hanger bands shall be flat and suitable for application of insulation over the hanger and pipe.
- B. Acceptable Manufacturers:
1. Modern Pipe Supports, Corp, Figures 48, 49, 59, and 403
  2. Approved Equal.
- C. Copper piping shall be supported with flat band copper hangers as hereinafter specified.
- D. All supports directly in contact with copper lines shall be all copper where possible or copper-plated where approved by the Architect. Ferrous metals shall not be used in contact with copper lines. Hangers shall be all-copper as hereinbefore specified.
- E. PVC coated steel hangers are acceptable on the condition that the coating is undamaged and without penetrations to the underlying steel.
- F. In lieu of copper band hangers, the Contractor will be permitted to use a steel clevis type hanger with the pipe insulation acting as an isolator to prevent electrolysis between the pipe and hanger. Clevis hanger shall be complete with hanger, adjuster, rod and insulation protection saddle
1. Acceptable Manufacturers:
    - a. Modern Pipe Supports Corp., Figure 590
    - b. Basic-PSA, Model BE 120
    - c. Anvil International, Figure 260
    - d. Approved Equal
- G. Clevis hangers are acceptable only as hereinbefore specified for copper tubing.

## 2.4 HANGER RODS

- A. Hanger rods installed in conjunction with hangers shall be not less than the following:

Pipe Size	Hanger Rod Diameter
1/2" to 2"	3/8"
2-1/2" and 3"	1/2"
4" and 5"	5/8"
6"	3/4"
8" to 12"	7/8"

- B. Hanger rods shall be larger where recommended by the hanger manufacturer.

## 2.5 PIPE SUPPORT SPACING

- A. Pipe supports shall be spaced as indicated below. Smaller pipe shall be provided with additional supports to prevent lines from sagging.

### MAXIMUM PVC AND COPPER PIPE SUPPORT SPACING

Pipe Size	PVC, FT	Copper, FT
Up to 1-1/2"	3	6
2" and Larger	4	8

### MAXIMUM STEEL PIPE SUPPORT SPACING

Pipe Size	Water Service, FT	Steam, Air & Gas Service, FT
1"	7	9
1-1/2"	9	12
2" & 2-1/2"	10	13
3"	12	15

- B. Where concentrated loads occur, closer spacing may be necessary.
- C. The Contractor shall minimize the sagging of pipe. Where piping is intended to slope (i.e. drains and condensate return lines), the Contractor shall maintain the slope of the piping to minimize pockets of standing water.

- D. Hangers must be installed not more than 2.5 pipe diameters from each change in horizontal direction of pipes.

## 2.6 SUPPORT OF VERTICAL PIPES

- A. All vertical runs of piping shall be supported at each floor and/or at specified intervals, by means of riser clamps or pipe lugs.
- B. Riser clamps with bolts and hex nuts shall be used for support of vertical lines in pipe spaces and other locations required.
- C. For vertical pipe runs, risers shall be suspended from or supported by steel spring isolators (Mason Industries type PC3ON hangers, type SLR mounts, or equal) and the piping restrained or guided by all-directional supports (Mason Industries type ADA, or equal). Steel spring deflections shall be 3/4", except in those expansion locations where additional deflection is required to limit deflection or load changes to +/- 25% of the initial stress.
- D. All vertical runs of piping shall be supported at each floor and/or at specified intervals, by means of riser clamps. Copper tubing shall be protected against electrolysis, such as PVC coating or plating, or by the use of an all-copper clamp. Riser clamps placed on floor construction in finished areas, including stairwells, will not be permitted.
- E. Copper tubing shall be protected against electrolysis, using PVC coating or plating, or by the use of an all-copper clamp.

## 2.7 SLEEVES

- A. Where vertical pipes pass through floors in mechanical equipment areas, chases or pipe spaces, the Contractor shall construct watertight sleeves made up of a section of Schedule 40 steel pipe extending 4" above the floor.
- B. Where vertical pipes pass through floors in finished spaces, the Contractor shall construct watertight sleeves made up of a section of steel pipe of proper length to extend through masonry and terminate flush on finish side.
- C. Where horizontal pipes pass through walls, sleeves shall be as specified above terminating flush with finish on each side.
- D. Where vertical pipes pass through plaster or dry wall ceilings, sleeves shall be No. 18 gauge galvanized steel flush with ceiling.
- E. Where piping is insulated, insulation shall be extended through sleeves. Sleeves shall be at least two sizes larger than the pipe or of suitable dimensions to allow the installation of pipe, insulation and sealant.
- F. At all locations space between sleeve and pipe shall be filled with sealant to level of sleeve. Sealant shall be Dow Corning 3-6548RTV or approved equal. Conform to manufacturer's recommended installation procedures.



- G. Sleeves and inserts shall be installed in concrete. Sleeves shall be large enough to receive the insulation and jackets.

## 2.8 INSERTS

- A. The Contractor shall place all hanger and support inserts in concrete. Special studs "shot" into concrete will not be permitted.
- B. All expansion shells shall be of the self-drilling types as manufactured by the Phillips Drill Company, Ramset, Rawlplug, or approved equal. Shells shall be the hammer installed, special flush or hanger rod types. Shells shall be installed with a drill-hammer.
- C. Lead expansion shields or lead wedge type shields are not permitted.
- D. Epoxy adhesive anchors, Hilti or equal, shall be used where specified on the design drawings.

## 2.9 ATTACHMENTS

- A. Beam clamps are permitted on 2-inch pipes with a service temperature of 180°F or less and shall be fixed or adjustable as manufactured by Modern Hangers, Penn Pipe Hanger Co., Arrow Pipe Hanger Co., or approved equal.

## 2.10 PENETRATIONS

- A. Seal all openings through walls of air plenum spaces and relief air shafts, where ducts, pipelines, etc. are installed under this Contract to assure airtight plenum spaces. Coordinate all work with contractors of other trades.
- B. Where pipes of any type pass through new fire and smoke barrier stops, ceilings, floors or walls, this Contractor shall thoroughly seal such openings with fire-rated sealant as required to maintain fire-rating of adjacent construction.
- C. Where exposed pipes pass through walls, floors or ceilings of finished rooms, furnish and install steel chromium-plated setscrew type floor, wall or ceiling plates.

## 2.11 PIPES SUPPORTED FROM STEEL JOISTS

- A. The weight of pipe supported from steel joists shall be distributed as follows:

Pipe Size	Minimum Requirement
2" and Smaller	Pipe shall be hung from one joist with beam clamps
2" to 3"	Pipe shall be suspended from 1-1/4" steel pipe or steel angle, laid-in and hook-bolted to the web members of the joists.
4" and 5"	Pipe shall be supported from three joists.

Pipe Size	Minimum Requirement
6" and over	Pipe shall be supported from not less than four joists

2.12 SUPPORT OF PIPES ALONG WALLS

- A. Lines along walls shall be supported on neat, substantial wall hangers securely attached to construction by means of inserts or expansion sleeves, or adhesive anchors, and bolts.
- B. Acceptable Manufacturers:
  - 1. Basic-PSA, Model BE 203, BE 204, and BE 205
  - 2. Modern Pipe Supports Corp, Figures 605, 606, 607, or 608
  - 3. Anvil International, Figure 194,195, and 199
  - 4. Approved Equal.

2.13 SUPPORT OF PIPES AT MECHANICAL EQUIPMENT CONNECTIONS

- A. All piping 3" or larger connected to mechanical equipment shall be mounted with steel spring isolators.
- B. The first three hangers or mounts near the mechanical equipment shall have the same static deflection as specified for the mountings under the connected equipment and shall be Mason Industries type PC30N (or approved equal).
- C. The first three hangers or mounts near the mechanical equipment, with no mountings under the equipment, shall be isolated by Mason Industries type 30N (or equal) hangers.
- D. Floor supported piping shall rest on restrained mounts, Mason Industries type SLR-MT (or approved equal).
- E. All other spring hangers and mounts, where specified, shall have a minimum static deflection of 3/4".

2.14 ANCHORS, GUIDES AND EXPANSION LOOPS

- A. Anchors and guides shall be constructed of structural members, pipe, and steel plates. Members shall be properly welded together with all corners mitered. Anchors and guides shall be bolted to structural members or joists. Anchors, guides, expansion joints, and expansion loops shall be installed to provide for proper expansion of piping.

2.15 RIGID ANCHOR

- A. Rigid anchors shall be shop or field fabricated as indicated on the drawings.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install hangers and supports in accordance with the IBC and ASME B31.1.
- B. All piping shall be supported from the building construction by the use of beam clamps, concrete inserts, brackets, or other equipment as dictated by the type of building construction.
- C. Trapeze type hangers may be used for multiple parallel line installations. The Contractor shall submit sketches for the proposed hangers indicating the type of construction, number and size of lines, and maximum spacing to the Construction Manager and the Architect/Engineer for approval.
- D. ALL hanger and support locations shall be coordinated and reviewed with the Architect, Structural, HVAC, Electrical and Fire Protection Engineer Construction Representatives during construction. If any hanger locations or connection methods are unacceptable to any of the professional team (for example – penetrations of pre-cast concrete tees, from piping, uneven spacing or height, etc.), the Contractor shall relocate the support, at his own expense, to an approved location.

### 3.2 UNACCEPTABLE HANGER AND SUPPORT INSTALLATIONS

- A. It is unacceptable to support any pipe(s) or duct(s) from other pipe(s) or duct(s).
- B. If unistrut is used to support piping, strap hangers are unacceptable since they do not allow for continuous insulation.
- C. It is unacceptable for this Contractor to support his work from the hangers of other trades. All trades must install their own hangers.
- D. It is unacceptable to attach supports to the building structure or concrete slabs using nails or a nail gun.
- E. It is unacceptable to support pipes using cable hangers.
- F. Unacceptable hanger and support installations shall be corrected as directed by the Architect/Engineer at no cost to the Owner.
- G. Unistrut is not acceptable to support pipes equal to or greater than 3 inches in diameter.
- H. Riser clamps placed on floor construction in finished areas, including stairwells, are not permitted.
- I. Strap hangers, wire hangers, or split-ring hangers are not acceptable.

- J. Perforated band iron, strap, split ring, wire, chain, or pipe hooks are not permitted for hangers or supports of pipe.
- K. Piping shall not be supported from any other piping systems, ductwork, conduit, etc.
- L. Attachments to, and penetrations of new or existing concrete structural tees for hanger connections **shall be not be permitted** until reviewed and approved by the Architect and Structural Engineer. The Contractor shall be responsible for the expense of all repairs required because of the installation of unauthorized attachments to, or penetrations of new or existing concrete structural tees.
- M. It is unacceptable to torch burn holes in structural steel to attach support components. All holes in structural steel must be approved by the engineer and drilled.
- N. Pipe roller supports shall not be used.

END OF SECTION 230529

## SECTION 230548 – SOUND AND VIBRATION CONTROL - HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The sound and vibration control for the various HVAC systems shall be as hereinafter described in this section.

### PART 2 - PRODUCTS

#### 2.1 VIBRATION AND NOISE CONTROL

- A. All equipment shall operate without objectionable noise or vibrations within Noise Criteria Curves listed in Sound and Vibration Control of the latest edition of the ASHRAE Handbook of HVAC Applications. Sound and vibration measurements shall conform with the ASHRAE Handbook of Fundamentals. If such objectionable noise or vibration shall be produced and transmitted to occupied portions of the building by apparatus, piping, ducts or other parts of this work, any necessary changes, as approved, shall be made without cost to the Owner. Noise levels shall conform with the requirements of OSHA.
- B. All mechanical equipment shall be isolated in accordance with the Latest Edition of the ASHRAE Handbook of HVAC Applications. Piping for the first three (3) support points away from remotely located mechanical equipment shall be isolated with Type 2 Isolators with a minimum deflection of 1.0 inches. All vibration isolators shall be of the same manufacturer where possible and shall be furnished by Consolidated Kinetics, Korfund, Vibration Eliminator Co. or approved equivalent.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Install vibration isolators, flexible connectors, etc per manufacturers recommendations.

END OF SECTION 230548

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## SECTION 23 0553 – EQUIPMENT AND PIPING IDENTIFICATION - HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The equipment and piping identification for the various HVAC systems shall be as hereinafter described in this section.

### PART 2 - PRODUCTS

#### 2.1 VALVE TAGS

- A. The Contractor shall tag each new valve, controller, and other devices requiring adjustment and affecting the performance of equipment furnished under this Contract. He shall prepare a list giving the number of each valve, its location, and the equipment or portion of the system tagged. The list shall be enclosed in a metal frame with glass and shall be hung where directed. Tags shall be of aluminum or brass, 2" in diameter with numbers as large as possible and attached by short, small link aluminum or brass chains or "S" hooks. Numbers and tags shall be coordinated with those being installed under the Plumbing Contract.
- B. Prepare a typewritten list giving the number of each valve, its location, and the equipment or portions of the system controlled. The list shall be enclosed in a metal frame with glass. The list shall be hung at location directed by the Architect.

#### 2.2 EQUIPMENT IDENTIFICATION

- A. Where valves, cleanouts, dampers, VVB's, CVB's, humidifiers, etc., are located above removable tile ceilings or above access panels the Contractor shall furnish and install identification labels on the corners of the access panels or the support grid of removable ceiling tiles. Labels shall be provided with the word "VALVES," "RELAY," "DAMPER," etc., so that the equipment may be readily located in the future. Additionally, label designations shall correlate with the equipment designations on the drawings.

- B. Identification labels shall not exceed 3" in length and 1" in height. Black letters shall be 1/4" high on white background. Labels shall be manufactured of engraved Micarta or Bakelite with pressure-sensitive backing and shall be nonabsorbent, nonporous and colorfast. Adhesive backing shall be chemically compounded to hold tight and fast at wide temperature extremes. Labels shall be as manufactured by Seton Name Plate Company, Brady Co., Kimball Systems, or approved equivalent. Labels shall be additionally secured with screws or rivets. Flexible plastic punched tapes will not be acceptable. Labels shall be coordinated with those being installed under other contracts.
- C. All major pieces of HVAC equipment shall include, at a suitable and accessible observation point on the equipment, a manufacturer's stamped brass or aluminum identification plate, with all pertinent capacity data stamped on the plate. Identification plate shall include all specific data, such as model number, serial number, motor data, horsepower, capacities, sizes, amperes, power consumption, speed, flows in GPM, temperatures, working pressures, operating pressures, and similar factors as applicable. In addition, pumps shall include total head in feet and impeller sizes.
- D. The Contractor shall be responsible for furnishing and attaching an identification plate for the above mentioned, major equipment if not provided by the equipment manufacturer.
- E. Equipment marking tags shall be engraved phenolic, 1/16" thick, four edges banded, black with white lettering. The tag shall be securely mounted to the equipment with minimum of two (2) - 3/8" long No. 3 screws. Tags shall provide such information as: "Exhaust Fan - EF1", "Air Handling Unit - AHU 1" and include "date of installation and project number".
- F. All piping shall be labeled with appropriate service designation as indicated in the table below, as well as with flow arrows at every 20 ft intervals and at every change of direction:

1. Pipe Designations Table.

<u>SERVICE</u>	<u>DESIGNATIONS</u>
Domestic Cold Water	C.W.
Domestic Hot Water	H.W.
Gas	GAS
Chemical Supply Pipes	(NAME)
Sanitary Drain	SAN
Storm Drain	STORM
Hot Water Supply	HWS
Hot Water Return	HWR
Sprinkler	SPRK
Standpipe	STANDPIPE

The installations will not be considered acceptable unless identification plates and nameplates are attached.

## PART 3 – EXECUTION

### 3.1 INSTALLATION



- A. Install per manufacturers recommendations.

END OF SECTION 23 0553

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## SECTION 23 0593 - TESTING ADJUSTING AND BALANCING OF SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The Scope of the Work includes the performance of testing, adjusting, and balancing of the HVAC systems, following the procedures defined herein and the preparation and submission of balancing reports.
- B. Circulating water piping systems, air distribution systems, and other heating, ventilating, and air conditioning equipment and systems installed under this Contract shall be balanced under this Contract.

#### 1.3 DEFINITIONS

- A. TAB – Testing, Adjusting and Balancing
- B. ATC – Automatic Temperature Controls

#### 1.4 SUBMITTALS

- A. Experience and qualifications of the proposed TAB Contractor shall be submitted for review by the Professional.
  - 1. The TAB Contractor shall be independent of the HVAC Contractor and shall have at least 5 years' experience providing TAB services.
  - 2. The TAB Contractor shall provide qualifications for balancing variable air volume systems, including a list of previous projects.
- B. Prior to the start of the Work, the TAB Contractor shall submit to the Professional a list of the balancing equipment and instruments he intends to use. The equipment must be first approved before being used on the project.
- C. The HVAC Contractor shall submit three (3) hard copies, or a PDF file, for each of the following:
  - 1. Circulating water systems balancing report.
  - 2. Air systems and related equipment balancing report.
  - 3. ATC system.

- D. A written report shall be prepared and submitted to the Professional after each site visit when adjustments to the HVAC system are required during the first heating and cooling seasons that it is in operation.

#### 1.5 GENERAL REQUIREMENTS

- A. The TAB Contractor shall be a sub-contractor to the HVAC Contractor and shall perform this work under the direction of the HVAC Contractor.
- B. The TAB Contractor shall be responsible for the testing, adjusting, and balancing work.
- C. The TAB Contractor shall be a member of the Associated Air Balance Council, or the National Environmental Balance Bureau. Balance reports shall be submitted on AABC or NEBB forms.
- D. Testing shall be as specified herein and in accordance with the aforementioned codes and best trade practices.
- E. The TAB Contractor shall furnish the labor, and supervision and shall furnish the instruments and provide the instrumentation required to perform the balancing work.
- F. Balancing of heating systems shall be performed when outside temperature is averaging less than 30 degrees F. and on cooling systems when outside temperature is above 80 degrees F.
- G. The HVAC Contractor shall enlist the cooperation of equipment manufacturers where needed to obtain proper equipment performance.
- H. The TAB Contractor shall furnish services for two (2) complete adjustments of the HVAC systems and controls, for the first cooling season and the first heating season. (A written report must be made to the Professional after each visit.)

#### 1.6 COORDINATION WITH ATC CONTRACTOR

- A. The ATC Contractor will provide software to be loaded on the TAB Contractor's computer for use in balancing the VAV system.
- B. The TAB Contractor shall be responsible for delivering his computer to the ATC Contractor's office to have the software loaded and at the same time receive training on proper use of the software package.
- C. During the project, the ATC Contractor will provide additional telephone support to the TAB Contractor on proper use of the software package.
- D. At the end of the project, the TAB Contractor shall be responsible for delivering his computer back to the ATC Contractor's office to have the balancing software deleted.

- E. In addition to any balancing and/or start-up assistance specified elsewhere in this section of the specifications, the ATC Contractor will include in his bid five (5) days of on-site technician time to aid the TAB Contractor in using the DDC system to configure required modes of operation for testing purposes. This time shall be consumed in full day increments, not necessarily concurrent, and must be scheduled with the ATC Contractor a minimum of one (1) week in advance of the actual need date.
- F. Should the TAB Contractor require additional assistance, he shall be responsible for compensating the ATC Contractor on a time-and-material basis.

## 1.7 DEMONSTRATION

- A. At the completion of the work and before final acceptance, the TAB Contractor shall place the piping, ductwork and equipment in proper operation, adjust the equipment, valves and control systems and make the necessary corrections.
- B. The TAB Contractor shall make final adjustments to the equipment and controls as may be required for proper operation, maintaining correct temperature in every part of the facility which may be impacted by the HVAC Contract.
- C. With approved supervisory employees, the HVAC Contractor, with the assistance of the TAB Contractor, shall demonstrate to representatives of the Professional and the Owner that the systems and equipment perform in accordance with their specific use as a part of the overall system and in accordance with the Contract requirements as evaluated and interpreted by the Professional or his representatives.
- D. During the tests, it shall be demonstrated that the systems will operate correctly.
- E. Controls will be adjusted by the control system manufacturer's mechanics and authorized representatives on the advice of the TAB Contractor.
- F. Leaks, faulty equipment, and poor workmanship shall be repaired or replaced by the HVAC Contractor. The related additional costs of rebalancing shall be borne by the HVAC Contractor.
- G. The TAB Contractor shall study and report on noise and vibration problems, which may develop in the course of system balancing.
- H. The HVAC Contractor, with the assistance of the TAB Contractor, shall perform the necessary corrective work required to demonstrate and prove the systems and equipment function in an approved manner.
- I. The demonstrations shall continue until the systems operate satisfactorily as determined by the Professional and his representative.

## PART 2 - PRODUCTS

### 2.1 NOT APPLICABLE TO THIS SECTION

## PART 3 - EXECUTION

### 3.1 BALANCING OF AIR SYSTEMS

- A. Supervise and perform the balancing of the air conditioning and ventilating systems to achieve the air quantities specified at each air inlet, outlet and damper shown on the Contract Drawings at the proper conditions of static pressure and temperature differential.
- B. The supply air, return air, and exhaust systems, under the HVAC Contract, shall be accurately balanced by means of a velometer to the CFM noted on the Drawings and the dampers and registers securely locked into position.
- C. The duct system accessories shall be adjusted and set for the proper airflow quantities and conditions, and the TAB Contractor shall adjust and set fans, VFD's, sheaves, dampers and adjustment mechanisms, including mechanical air valves.
- D. Diffusers, registers, and grilles shall be set for proper air distribution and for comfortable conditions.
- E. The TAB Contractor shall follow the variable volume box or diffuser manufacturer's recommendations for balancing the variable volume air systems.
- F. Manual dampers, on the main supply air, return air, and exhaust duct risers at the shafts, shall each be tagged with the quantity of airflow and the static pressure set point of the damper. Tags shall be brass or aluminum and shall securely attached to the damper handle. The set point position on the damper shall be permanently marked.
- G. The entire air balance shall be completed before the water balance is started.

### 3.2 BALANCING OF CIRCULATING WATER SYSTEMS

- A. Supervise and perform the balancing of the circulating water systems and parts thereof installed under the Heating Contract to obtain the water flow rates and temperature drops in accordance with the system design concept and functional intent as determined by the Professional.
- B. After adjustment and balancing of each water heating coil and chilled water coil, the TAB Contractor shall securely attach a brass or aluminum tag to the element return piping, within the enclosure, designating the GPM and pressure drop through the coil.

### 3.3 TAB INSTRUMENTS

- A. The TAB Contractor shall furnish the instruments and provide the instrumentation required to perform the above work.
- B. The following is a list of the minimum instruments required:
  - 1. Combination inclined-vertical manometer.
  - 2. Differential pressure gauges.

3. Pitot tubes.
4. Hook gauges.
5. Magnehelic gauges.
6. Multi-point pyrometers.
7. Thermal anemometers.
8. Inclined manometers.
9. Insertion thermometers.
10. U-tube manometers.
11. Contact pyrometers.
12. Stethoscopes.
13. Velometer with probes.
14. Water pressure gauges.
15. Rotating vane anemometers.
16. Smoke bombs.
17. Clamp-on volt-ammeters.
18. Tachometers and tips.
19. Sling psychrometers.
20. Air pressure gauges.
21. Taps, tubing, valves, cocks, rubber tubing and like miscellaneous items.

### 3.4 GENERAL REQUIREMENTS FOR BALANCING REPORTS

- A. These reports shall certify test methods and instruments used, the readings obtained, temperature and pressure drops, RPM of equipment, amperage of the motors, and balancing problems encountered and suggestions.
- B. Reports shall be submitted to the Professional and shall include data on the tests in the form normally used by AABC or NEBB; but varied as required to suit these specifications.

### 3.5 AIR SYSTEM BALANCE REPORT

- A. The air system balance report, prepared by the TAB Contractor, shall include the CFM at outlet or inlet of each grille, diffuser, and register.
- B. Report shall include fan curves for the final speeds developed from the fan manufacturer's performance test data for the major fans.
- C. With the air systems set to handle the normal outdoor air quantity, the TAB Contractor shall perform the following tests, compile information, and submit written reports to the Professional on the following:
  1. Air Handling Equipment
    - a. Design Conditions
      - 1) CFM Supply Air, and Exhaust Air (Each System)
      - 2) Static Pressure
      - 3) Motor HP
      - 4) Fan RPM

- 5) Outlet Velocity
- b. Installed Equipment
  - 1) Fan Manufacturer, Size, Model Number (Supply and Exhaust)
  - 2) Motor, Frame and Manufacturer
  - 3) Motor Size/Model Number
  - 4) Motor HP, Voltage, Phase, Full Load Amperage, RPM
  - 5) Belt size/Model Number, and number of belts
  - 6) Sheave size and make
  - 7) Sheave bore size
  - 8) Sheave keyway size
- c. Field Test
  - 1) Fan Speed
  - 2) No load operation amperes
  - 3) Fan motor operating amperes
  - 4) Calculated BHP
- d. Test for Total Air
  - 1) Size of supply air, and exhaust air ducts
  - 2) Number and locations of velocity readings taken and static pressure readings taken
  - 3) Duct average velocity
  - 4) Supply Air CFM
  - 5) Outside Air CFM
  - 6) Exhaust Air CFM
- 2. Individual inlets and outlets (Diffusers, Registers and/or Grilles)
  - a. Identify each outlet or inlet as to location area and fan system.
  - b. Manufacturer and type
  - c. Size
  - d. Free area, core area or neck area
  - e. Required FPM and test velocity found for each
  - f. Required CFM and test results for each
- D. Testing and adjusting of individual outlets shall be performed under procedures recommended by the manufacturers of the outlets.
- E. Outlets shall be set for air pattern required and air dampers shall be adjusted and set for design CFM indicated.
- F. Any required changes in air patterns, settings, or any other miscellaneous changes necessary for achieving correct air balance, shall be provided under this Contract.
- G. Total CFM of outlets shall agree with total CFM of branches and the grand total shall agree with the air volume for the fans.



### 3.6 WATER SYSTEM BALANCE REPORT

- A. The water system balance report, prepared by the TAB Contractor, shall indicate the GPM and the pressure drop through each coil of each unit after balancing is completed.
- B. The TAB Contractor shall perform the following tests, compile information and submit written reports to the Professional on the following:

1. Pumps

a. Design Data

- 1) GPM, Head
- 2) RPM, BHP

b. Installed Equipment

- 1) Manufacturer, Size
- 2) Type Drive
- 3) Motor HP, Volts, Cycles and Phase
- 4) Full Load Amperes

c. Field Test

- 1) Discharge Pressures: Full flow and no flow
- 2) Suction Pressures: Full flow and no flow
- 3) Operating Head and GPM
- 4) No load amperes (where possible)
- 5) Full flow amperes, no flow amperes
- 6) Calculated BHP

2. Heat transfer equipment.

a. Design Data

- 1) MBH specified, GPM specified.
- 2) Entering Water Temperature (E.W.T.)
- 3) Entering Air Temperature (E.A.T.)
- 4) Water Temperature Drop (W.T.D.)
- 5) Element Type Specified.

b. Field Test

- 1) Identify each element as to location.
- 2) Required water temperature drop.
- 3) Actual entering air temperature and water (GPM) through the coil.
- 4) Adjust element until required temperature drop is obtained.

END OF SECTION 230593

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## SECTION 230700 – HVAC INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The insulation for the various HVAC systems shall be as hereinafter described in this section.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Fiberglass insulation shall be as manufactured by Owens Corning, CertainTeed, Johns-Manville, Knauf, or approved equal.
- B. Manufacturer's names are indicated herein to denote a standard of quality and type only. Products of other manufacturers not mentioned herein will be acceptable providing they meet the requirements of these Specifications in quality and type and are submitted according to Section 230506, Paragraph 1.4.
- C. The materials, finish and adhesive herein specified, shall be listed and inspected by Underwriters Laboratories Incorporated. Covering, vapor barriers, and adhesives used in this application shall have a flame spread classification of not more than 25 and a smoke developed rating of not more than 50, based on tests in accordance with ASTM Standard E84, "Methods of Tests for Surface Burning Characteristics of Building Materials," except as hereinafter specified. Each product shall bear the label Underwriters Laboratories. Products used on this project shall be classified as "non-combustible" by NFPA.

#### 2.2 HOT PIPING SYSTEM INSULATION

- A. Hot piping systems shall include the following:
  - 1. Hot Water Supply and Return (HWS & R)
  - 2. Drain piping
  - 3. Relief valve piping
  - 4. Vent piping
- B. Hot piping system insulation, except where specified otherwise, shall be glass fiber pipe insulation with white Type ASJ jacket, Owens Corning FIBERGLAS™ pipe insulation or

approved equal. End and transverse joints shall be wrapped with factory-furnished sealing strips of same material as jackets. Horizontal laps and end joints shall be sealed down with Foster® 85-20™ Spark-Fas® Adhesive, non-flammable, vapor barrier adhesive.

- C. Exterior hot piping Insulation shall be the same as specified for hot piping systems. Thickness shall comply with the table in Paragraph 2.4 but shall be no less than 2 inches. Insulation shall be covered with a Type ASJ jacket and a Childers 0.016" smooth aluminum exterior weatherproof jacket neatly banded and sealed in place.

## 2.3 INSULATION THICKNESS AND THERMAL CONDUCTIVITY

- A. Insulation thickness shall comply with the following table for the pipe service and fluid temperatures indicated:

Minimum Pipe Insulation Thickness, Inches								
Pipe Designation	Fluid Temperature Range, °F	Insulation Conductivity		Nominal Pipe or Tube Size, Inches				
		Conductivity, k, BTU • IN / HR FT² • °F	Mean Rating Temperature, °F	< 1	1 to < 1½	1½ to < 4	4 to < 8	≥ 8
HWS & R Drain, Relief Valve, and Vent Piping	141 – 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
	105 – 140	0.21 – 0.28	100	1.0	1.0	1.5	1.5	1.5
Condensate Drain Lines	40 – 60	0.21 – 0.27	75	1.0	1.0	1.0	1.0	1.0

For piping smaller than 1½ inch and located in partitions within conditioned spaces, reduction of these thicknesses by 1 inch shall be permitted, but not to a thickness less than 1 inch.

## 2.4 HOT PIPING SYSTEM EQUIPMENT INSULATION

- A. The following shall be insulated with 2" thick tank insulation and jacketing as specified for hot piping systems.
- Air Separators
  - Expansion Tanks
- B. Tank insulation shall be FIBERGLAS™ Pipe and Tank Insulation as manufactured by Owens Corning or approved equal.
- C. Tank insulation shall be cut and mitered as necessary to fit the shape of the tank and shall be banded in place in strict accordance with the manufacturer's requirements. Joints shall be pointed with insulating cement.

- D. Joints shall be pointed with insulating cement. Insulation for the equipment shall be covered with an all service jacket (ASJ) with seams overlapped and sealed with Foster® 85-20™ Spark-Fas® Adhesive, non-flammable, vapor barrier adhesive and vapor barrier tape.

## 2.5 HOT PIPING SYSTEM FITTINGS

- A. Fittings on Interior Hot Piping Systems shall be insulated with fiberglass, factory-fabricated pipe fitting insulators the full thickness of pipe insulation. Insulation fittings shall be held in place with glass gauze wired on or stapled. Gauze shall be covered with a fire-resistant white coating applied in two (2) equal coats in the amount of four (4) gallons per each 100 sq. ft. by brush or spray to entire fitting surface similar to Foster® 30-35™ Tite-Fit™. Coating shall be covered with a flameproof canvas sealed in place. Canvas shall be wrapped on and sealed with Benjamin Foster flame resistant sealer. Cloth shall be applied after coating has dried.
- B. Flanged and Union Connections and Valves on Hot Piping Systems shall not be insulated; however, insulation shall be neatly tapered at flanges, unions and valves with insulating cement, and held in place by flameproof canvas wrapped on and pasted, as specified for fittings. Flanges and union connections and valves on cold water piping shall be insulated similar to that herein specified for chilled water lines except thickness shall be equal to the adjacent pipe insulation.

## 2.6 COMMON INSULATION REQUIREMENTS FOR PIPING SYSTEMS

- A. Seams, overlaps and end joints shall be thoroughly sealed down with Foster® 85-20™ Spark-Fas® Adhesive or Foster® 85-75 Drion® Contact Cement vapor barrier adhesive as required. Ends of pipe insulation shall be sealed off at valves, fittings, flanges and every 20'-0" on straight runs with Foster® 30-35™ Tite-Fit™ Coating. The entire installation shall be sealed and free of condensation.
- B. Insulation shall be applied with Bostitch outward clinched staples, one (1) every 3" and four (4) at each butt strap.
- C. In lieu of pre-molded insulation fittings, the Contractor will be permitted to insulate pipe fittings with mitered and segmented fiberglass pipe insulation with elbows and changes of direction mitered, segmented and rounded to a thickness equal to the adjacent insulation, and thoroughly sealed and wrapped. Square cornered mitered joints will not be permitted. Field applied mitered and rounded insulation shall be held in place with reinforced glass cloth and vapor barrier insulating cement applied as specified above for pre-molded fittings. Coating shall be covered with 8 oz. flameproof canvas jacket sealed in place.
- D. Insulation shall be applied over clean dry surfaces with the pipe at approximately room temperature. The installations shall be sealed and shall be free of condensation.
- E. Fittings including tees, 90 degree fittings, 45 degree fittings, etc., shall be covered in strict accordance with the recommendations of the manufacturer of the pre-molded insulators. Joints and overlaps at fittings shall be buttered with fire resistant vapor barrier sealer.
- F. In lieu of the pre-molded fittings previously specified herein, pre-molded one-piece PVC insulated fitting covers, with factory-precut and marked fiberglass All-Temp insulation,

Zeston® 2000 PVC, as manufactured by Johns Manville, will be acceptable. Insulation shall fully cover the fitting and the covers shall be stapled and taped in place. Tapes shall be off-white and shall be of the pressure sensitive type furnished by the fitting manufacturer. Bands are not permitted. Ends shall be overlapped. Fittings on cold piping systems shall have all edges sealed with Zeston® Fire-resistant vapor barrier adhesive. The circumferential edges shall be wrapped with Zeston® fire-resistant vapor barrier sensitive Z-tape. The tape shall extend over the adjacent pipe insulation and have an overlap on itself at least 2" on the downward side. Cold pipe system fittings shall have at least two (2) layers of factory-precut All-Temp insulation inserts. Installations shall be sealed and free of condensation. Fittings shall be installed in strict accordance with the fitting manufacturer's recommendations and details. Twine shall be used for securing insulation at chilled water and cold water installations.

- G. Where certain thicknesses of pre-molded fitting insulators are not available from the manufacturer, the fitting insulation shall be one (1) size smaller than the pipe insulation and shall be built up to the correct thickness with vapor barrier cement. Where necessary, fitting shall be mitered and segmented to a thickness equal to the adjacent insulation and shall be sealed and wrapped. Pre-molded fittings shall be installed to the satisfaction of the Architect and shall be removed and replaced at the direction of the Architect where the installation is not completed in a neat and workmanlike manner. Pre-molded fittings shall have surfaces level, smooth and uniform without bulges, changes in thickness or uniformity.
- H. Pipe covering shall not be installed on flanged or screwed fittings until connections have been tested and are free of leaks.
- I. Insulation on piping shall extend full size through oversized floor, ceiling or wall sleeves. Piping shall be fully insulated except where specifically mentioned otherwise.
- J. Glass cloth, fireproof canvas, vapor barrier sealer and adhesive shall be of types which can suitably be painted.
- K. In lieu of sealing all-service jackets with a field applied vapor barrier adhesive, the Contractor may use factory applied pressure sensitive laps provided the pressure sensitive laps are guaranteed to remain sealed for the life of the insulation. Guarantee letters must be submitted in triplicate from the insulation manufacturer and the Heating Contractor. In lieu of the lifetime guarantee, the Contractor may use factory applied sensitive laps and additionally staple overlaps as hereinbefore specified.
- L. Branch piping in confined equipment spaces where approved by the Architect, may be insulated with 3/4" thickness Armaflex FR fire resistant flexible tubing insulation if desired. Ends and joints shall be thoroughly sealed. Armaflex FR flexible tubing insulation shall not be installed in any other locations.

## 2.7 REFRIGERANT PIPING INSULATION

- A. Suction and liquid piping less than or equal to 1-1/2", valves and accessories shall be insulated with 1" thickness Type FR Armaflex, or approved equivalent, flexible tubing insulation. Suction and liquid piping greater than 1-1/2" shall have 1.5" thick insulation. Insulation exposed to weather shall be painted with two (2) coats of Armaflex Finish, or approved equivalent, protective coating.

2.8 INTERIOR RECTANGULAR DUCT INSULATION (DUCT LINER)

- A. Interior supply low and medium velocity heating and air conditioning supply air ducts shall be lined 1.5" thick insulation with a minimum R-6 value.
- B. Ductwork, including return air, located in unheated spaces, like vented attics, shall be lined with 2" thick insulation with a minimum R-8.
- C. Duct lining shall be not less than 1-1/2 lb. density glass fiber with neoprene fire-resistant coating or mat facing. Coatings shall meet the requirements of NFPA No. 90A. Insulation shall have a noise reduction coefficient of not less than 0.70. Duct lining shall be moisture-proof, fire-resistant, vermin-proof and shall have a low coefficient of friction.
- D. Insulation shall be installed in duct runs complete to air outlets.
- E. Transfer air ducts shall be lined similar to the above, except insulation thickness shall be 1/2". Exhaust ducts and relief air shall not be lined.
- F. Duct liner may be "formed" for all ducts with largest dimensions not exceeding 12". Ducts shall be lined by carefully adhering the insulation liner in a continuous piece to clean flat metal sheets with a quick-tacking, rubber based adhesive, spread over the entire duct surface and forming the liner with the metal through the brake.
- G. Liner shall be additionally attached to the interior of the ducts by means of weld pins installed through the insulation into the ductwork and spaced not over 18" on centers, but not less than two (2) rows per side. Weld pins shall not be used on aluminum ductwork.
- H. Gripnails are acceptable for attaching duct liner to ductwork.
- I. The coated side of the duct liner shall face the air stream. Exposed edges of insulation shall be covered with adhesive and tape. Liner installation shall also conform to SMACNA Standards.
- J. Duct liner shall be individually "cut" for ducts with largest dimensions exceeding 12". Ducts shall be lined by cutting pieces to fit snugly to the interior of the duct surfaces. The liner shall be fastened to the duct with a heavy coat of quick-tacking, rubber-based adhesive spread over the entire duct surface. The top and bottom pieces shall lap the side pieces, and exposed edges of the insulation at the duct ends shall be covered with adhesive and tape. Individually "cut" insulation shall be additionally attached to the duct with weld pins or Gripnails, as herein specified.
- K. Where ductwork is to be lined with insulation, duct dimensions indicated on the Drawings are inside the insulation. Shape and location of ducts may be changed to suit building conditions, but equivalent area must be maintained.
- L. Return air and exhaust ductwork shall not be insulated except where specified herein.
- M. Duct liner shall be as manufactured by Owens-Corning, Knauf, Certainteed Corp., Manville Products, or approved equal.
- N. In lieu of installing duct liner in round spiral duct that is concealed above ceilings, the Contractor may externally wrap with 2" thick and 1-1/2 lb. density glass fiber insulation with a

vapor barrier as manufactured by Knauf, Owens, Corning, John Manville or approved equal (R-6 minimum installed value). Vapor barrier shall be taped and sealed as required to prevent condensation

## 2.9 INTERIOR ROUND SPIRAL DUCT INSULATION (DUCT LINER)

- A. Round spiral duct, for supply and outdoor air service, shall be insulated with spiral duct liner to control noise and eliminate condensation for both concealed and exposed applications.
- B. Acceptable Manufacturers:
  - 1. Owens Corning QuietZone® Spiral Duct Liner
  - 2. CertainTeed
  - 3. Johns Manville
- C. Spiral duct liner shall be rigid, resin bonded fibrous glass board with a damage-resistant, flame retardant, veil faced airstream surface, and a reinforced aluminum foil (FRK) backing.
- D. Insulation thickness shall be 1.5 inches with a minimum thermal resistance of R-6.5.
- E. Insulation shall be for service at internal air velocities not to exceed 6000 FPM.
- F. Insulation shall be fabricated with a glass mat on the airstream side to resist damage during installation and in service.
- G. Spiral duct liner product shall be UL listed and labeled.
- H. Provide accessories as recommended by the insulation system manufacturer including adhesives.
- I. Fully cover the interior of the duct with insulation. Neatly butt transverse joints without interruptions or gaps.
- J. Install the mat faced surface of the duct liner facing the airstream.
- K. Complying with requirements of ASTM C916, adhere duct liner to the sheet metal with 90% coverage of adhesive.
- L. Coat exposed leading edges and transverse joints during fabrication.
- M. Do not coat the grooved longitudinal edges.
- N. Do not install two (2) layers of duct liner to meet a specified liner thickness.

## PART 3 – EXECUTION

### 3.1 GENERAL INSTALLATION



- A. Insulation shall be installed by an Insulation Subcontractor responsible to the Heating Contractor. Insulation shall be installed in a neat and workmanlike manner by workmen skilled in the installation and handling of commercial and industrial insulation for piping, ductwork, and equipment.
- B. Insulation shall be installed as recommended by the insulation manufacturer.

### 3.2 PIPING SYSTEMS

- A. Insulation shall be applied on clean, dry surfaces after pressure testing and approval. Insulation shall be continuous, including through wall and ceiling openings and sleeves. Insulation on piping systems operating at 60 degrees or less shall be maintained with a continuous unbroken vapor seal. Hangers, supports, anchors, guides and equipment shall be insulated, and vapor sealed to prevent condensation.
- B. Covered pipe shall be located a sufficient distance from walls, other pipes, ductwork, and other obstacles to permit the application of the full thickness of insulation specified; and if necessary, extra fittings and pipes shall be used.
- C. Fiberglass insulation shall be installed with Bostitch outward clinched staples, one (1) every 3" and four (4) at each butt strap.
- D. Insulation shall not be applied to any piping or equipment until pressure tests have been performed and approved by the Architect. Surfaces shall be clean and dry when insulation is installed.
- E. Piping located in walls, in pipe chases, in crawl spaces, or above ceilings shall be considered as concealed. Other locations shall be considered as exposed unless otherwise specified herein.
- F. Insulated piping (including piping with vapor barrier jacket) shall be wrapped with factory applied ASJ all-service jackets securely sealed in place with Benjamin Foster fire-resistant sealer. All-service jackets shall be heavy density, white, suitable for operating temperatures from -60 degrees F. to +450 degrees F., with vinyl coated and embossed vapor barrier laminate. All-service jackets shall be the Owens-Corning Fiberglass ASJ-25 or approved equal. All-service jackets shall have a vapor transmission rating of approximately .02 perms.
- G. Piping furnished and installed under this Contract shall be insulated unless specifically indicated otherwise.

END OF SECTION 230700

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## SECTION 230800 - MECHANICAL SYSTEMS COMMISSIONING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. ASHRAE Guideline 1.1 – 2007: HVAC & R Technical Requirement for Commissioning Process
- C. ASHRAE Application Handbook – 2011, Chapter 43 – Building Commissioning
- D. ASHRAE Guideline 4 – 2008: Preparation of Operating and Maintenance Documentation for Building Systems

#### 1.2 DESCRIPTION

- A. The purpose of this section is to specify HVAC commissioning process.
- B. Commissioning is required to ensure that all systems are operating in a manner consistent with the Contract Documents. The mechanical, controls and tab contractors, shall be familiar with all parts of the commissioning plan issued by the CX Agent change throughout and shall execute all commissioning responsibilities assigned in the Contract Documents.
- C. The following is a list of equipment to be commissioned:
  - 1. HVAC
    - a. Packed Rooftop Units
    - b. HW Circulating Pumps
    - c. Under Floor Heating Systems (Pumps)
    - d. VVB's
    - e. Exhaust Fans
    - f. Air Curtains
    - g. Boiler – Wall Hung
    - h. Ductless Split Air Conditioning Systems

#### 1.3 RESPONSIBILITIES

- A. Mechanical, Controls and TAB Contractors. The commissioning responsibilities applicable to each of the mechanical, controls and TAB contractors of Division 23 are as follows.

*Construction and Acceptance Phases*

1. Include and itemize the cost of commissioning in the contract price.
2. In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, O&M data and training.
3. Attend a commissioning scoping meeting and other meetings necessary to facilitate the process.
4. Contractors shall provide the Design Professional with normal cut sheets and shop drawing submittals of commissioned equipment.
5. Provide additional requested documentation, prior to normal O&M manual submittals, to the Design Professional for development of start-up and functional testing procedures.
  - a. Typically, this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.
  - b. The Design Professional may request further documentation necessary for the commissioning process.
  - c. This data request may be made prior to normal submittals.
6. Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the Design Professional for review and approval.
7. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
8. Provide limited assistance to the Design Professional in preparing the specific functional performance test procedures. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
9. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the pre-functional checklists from the Design Professional for all commissioned equipment. Submit to Design Professional for review and approval prior to startup.
10. During the startup and initial checkout process, execute the mechanical-related portions of the pre-functional checklists for all commissioned equipment.
11. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the Design Professional.
12. Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems.
13. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.
14. Provide skilled technicians to perform functional performance testing under the direction of the Design Professional for specified equipment in Section 15. Assist the Design Professional in interpreting the monitoring data, as necessary.

15. Correct deficiencies (differences between specified and observed performance) as interpreted by the Design Professional, and Owner's Representative and retest the equipment.
  16. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
  17. During construction, maintain as-built redline drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing).
  18. Provide training of the Owner's operating staff using expert qualified personnel, as specified.
  19. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.  
*Warranty Period*
  20. Execute seasonal or deferred functional performance testing, witnessed by the Design Professional, according to the specifications.
  21. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.
- B. Mechanical Contractor. The responsibilities of the HVAC mechanical contractor, during construction and acceptance phases in addition to those listed in (A) are:
1. Provide startup for all HVAC equipment, except for the building automation control system.
  2. Assist and cooperate with the TAB contractor and Design Professional by:
    - a. Putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.
    - b. Including cost of sheaves and belts that may be required by TAB.
    - c. Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Providing an approved plug.
  3. Install a P/T plug at each water sensor which is an input point to the control system.
  4. List and clearly identify on the as-built drawings the locations of all air-flow stations.
  5. Prepare a preliminary schedule for Division 23 pipe and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the Design Professional. Update the schedule as appropriate.
  6. Notify the General Contractor or Design Professional depending on protocol, when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and TAB will occur. Be responsible to notify the General Contractor or Design Professional ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that commissioning processes are executed and that the Design Professional has the scheduling information needed to efficiently execute the commissioning process.
- C. Controls Contractor. The commissioning responsibilities of the controls contractor, during construction and acceptance phases in addition to those listed in (A) are:

1. Sequences of Operation Submittals. The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:
  - a. An overview narrative of the system (1 or 2 paragraphs) generally describing its purpose, components and function.
  - b. All interactions and interlocks with other systems.
  - c. Detailed delineation of control between any packaged controls and the building automation system, listing what points the BAS monitors only and what BAS points are control points and are adjustable.
  - d. Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included but will generally require additional narrative).
  - e. Start-up sequences.
  - f. Warm-up mode sequences.
  - g. Normal operating mode sequences.
  - h. Unoccupied mode sequences.
  - i. Shutdown sequences.
  - j. Capacity control sequences and equipment staging.
  - k. Temperature and pressure control: setbacks, setups, resets, etc.
  - l. Detailed sequences for all control strategies, e.g., optimum start/stop, staging, optimization, demand limiting, etc.
  - m. Effects of power or equipment failure with all standby component functions.
  - n. Sequences for all alarms and emergency shut downs.
  - o. Seasonal operational differences and recommendations.
  - p. Initial and recommended values for all adjustable settings, set points and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
  - q. Schedules, if known.
  - r. To facilitate referencing in testing procedures, all sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered.
2. Control Drawings Submittal
  - a. The control drawings shall have a key to all abbreviations.
  - b. The control drawings shall contain graphic schematic depictions of the systems and each component.
  - c. The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
  - d. Provide a full points list with at least the following included for each point:
    - 1) Controlled system
    - 2) Point abbreviation
    - 3) Point description
    - 4) Display unit

- 5) Control point or setpoint (Yes / No)
- 6) Monitoring point (Yes / No)
- 7) Intermediate point (Yes / No)
- 8) Calculated point (Yes / No)

Key:

Point Description: DB temp, airflow, etc.

Control or Set point: Point that controls equipment and can have its set point changed (OSA, SAT, etc.)

Intermediate Point: Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset).

Monitoring Point: Point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or performance verification.

Calculated Point: “Virtual” point generated from calculations of other point values.

The Controls Contractor shall keep the CA informed of all changes to this list during programming and setup.

- 3. An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.
- 4. Assist and cooperate with the TAB contractor in the following manner:
  - a. Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).
  - b. For a given area, have all required pre-functional checklists, calibrations, startup and selected functional tests of the system completed and approved by the CA prior to TAB.
  - c. Provide a qualified technician to operate the controls to assist the TAB contractor in performing TAB or provide sufficient training for TAB to operate the system without assistance.
- 5. Assist and cooperate with the CA in the following manner:
  - a. Using a skilled technician who is familiar with this building, execute the functional testing of the controls system. Assist in the functional testing of all equipment specified.

6. The controls contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional performance testing. At minimum, the plan shall include for each type of equipment controlled by the automatic controls
    - a. System name.
    - b. List of devices.
    - c. Step-by-step procedures for testing each controller after installation, including:
      - 1) Process of verifying proper hardware and wiring installation.
      - 2) Process of downloading programs to local controllers and verifying that they are addressed correctly.
      - 3) Process of performing operational checks of each controlled component.
      - 4) Plan and process for calibrating valve and damper actuators and all sensors.
      - 5) A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
    - d. A copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each point and clearly indicate when a sensor or controller has “passed” and is operating within the contract parameters.
    - e. A description of the instrumentation required for testing.
    - f. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Design Professional and TAB contractor for this determination.
  7. Provide a signed and dated certification to the Design Professional and Owner upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements.
  8. Beyond the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points.
  9. List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).
- D. TAB Contractor. The duties of the TAB contractor, in addition to those listed in (A) are:
1. Six weeks prior to starting TAB, submit the qualifications of the site technician for the project, including the name of the contractors and facility managers of recent projects the technician on which was lead. The Owner will approve the site technician's qualifications for this project.
  2. Submit the outline of the TAB plan and approach for each system and component to the Design Professional, HVAC Contractor and the controls contractor six weeks prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system.
  3. The submitted plan will include:



- a. Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.
  - b. An explanation of the intended use of the building control system. The controls contractor will comment on feasibility of the plan.
  - c. All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
  - d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
  - e. Final test report forms to be used.
  - f. Detailed step-by-step procedures for TAB work for each system and issue: flow calibration diffuser proportioning, branch / sub-main proportioning, total flow calculations, rechecking, diversity issues, expected problems and solutions, etc. Criteria for using air flow strengtheners or relocating flow stations and sensors will be discussed. Provide the analogous explanations for the water side.
  - g. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
  - h. Details of how *total* flow will be determined (Air: sum of terminal flows via BAS calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations. Water: pump curves, circuit setter, flow station, ultrasonic, etc.).
  - i. The identification and types of measurement instruments to be used and their most recent calibration date.
  - j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and provide methods to verify this.
  - k. Confirmation that TAB understands the outside air ventilation criteria under all conditions.
  - l. Details of how building static and exhaust fan damper capacity will be checked.
  - m. Details of methods for making any specified coil or other system plant capacity measurements.
  - n. Details of any TAB work to be done in phases (by floor, etc.), or of areas to be built out later.
  - o. Details regarding specified deferred or seasonal TAB work.
  - p. Details of any specified false loading of systems to complete TAB work.
  - q. Details of all exhaust fan balancing and capacity verifications, including any required room pressure differentials.
  - r. Details of any required interstitial cavity differential pressure measurements and calculations.
  - s. Plan for hand-written field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
  - t. Plan for formal progress reports (scope and frequency).
  - u. Plan for formal deficiency reports (scope, frequency and distribution).
4. The TAB field technicians shall keep a running log of events and issues. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the Design Professional and Owner at least twice a week.

5. Communicate in writing to the controls contractor all set point and parameter changes made or problems and discrepancies identified during TAB, which affect the control system setup and operation.
6. Provide a draft TAB report within two (2) weeks of completion. A copy will be provided to the Design Professional. The report will contain a full explanation of the methodology, assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC, NEBB or ASHRAE Standard 111.
7. Provide the Design Professional with any requested data, gathered, but not shown on the draft reports.
8. Provide a final TAB report for the Design Professional with details, as in the draft.
9. Conduct functional performance tests and checks on the original TAB.

## PART 2 - PRODUCTS

### 2.1 TEST EQUIPMENT

- A. Division 23 shall provide all test equipment necessary to fulfill the testing requirements of this Division.
- B. Refer to Section 230593 for additional Division 23 requirements.

## PART 3 - EXECUTION

### 3.1 SUBMITTALS

- A. Division 23 shall provide submittal documentation relative to commissioning as required in this Section Part 1.

### 3.2 STARTUP

- A. The HVAC mechanical and controls contractors shall follow start-up and initial checkout procedures. Division 23 has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.
- B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the Design Professional. Beginning system testing before full completion does not relieve the Contractor from fully completing the system, including all pre-functional checklists as soon as possible.

### 3.3 TAB

- A. Refer to the TAB responsibilities in Part 1.2 above.

### 3.4 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.
- B. Division 23 shall compile and prepare documentation for all equipment and systems covered in Division 23 and deliver this documentation to the HVAC Contractor for inclusion in the O&M manuals, according to this section prior to the training of owner personnel.
- C. The Design Professional shall receive a copy of the O&M manuals for review.
- D. Special Control System O&M Manual Requirements. In addition to documentation that may be specified elsewhere, the controls contractor shall compile and organize at minimum the following data on the control system in labeled 3-ring binders with indexed tabs.
1. Three copies of the controls training manuals in a separate manual from the O&M manuals.
  2. Operation and Maintenance Manuals containing:
    - a. Specific instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. These instructions shall be step-by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included.
    - b. Full as-built set of control drawings (refer to Submittal section above for details).
    - c. Full as-built sequence of operations for each piece of equipment.
    - d. Full print out of all schedules and set points after testing and acceptance of the system.
    - e. Full as-built print out of software program.
    - f. Electronic copy on disk of the entire program for this facility.
    - g. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.
    - h. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
    - i. Control equipment component submittals, parts lists, etc.
    - j. Warranty requirements.
    - k. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
  3. The manual shall be organized and subdivided with permanently labeled tabs for each of the following data in the given order:
    - a. Sequences of operation
    - b. Control drawings
    - c. Points lists
    - d. Controller / module data
    - e. Thermostats and timers

- f. Sensors and DP switches
  - g. Valves and valve actuators
  - h. Dampers and damper actuators
  - i. Program setups (software program printouts)
4. Field checkout sheets and trend logs should be provided to the Design Professional for inclusion in the Commissioning Record Book.
- E. Special TAB Documentation Requirements. The TAB will compile and submit the following with other documentation that may be specified elsewhere in the *Specifications*.
  1. Final report containing an explanation of the methodology, assumptions, test conditions and the results in a clear format with designations of all uncommon abbreviations and column headings.
  2. The TAB shall mark on the drawings where all traverse and other critical measurements were taken and cross reference the location in the TAB report.
- F. Review and Approvals. The Design Professional shall review of the commissioning related sections of the O&M manuals.

### 3.5 TRAINING OF OWNER PERSONNEL

- A. The HVAC Contractor shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed.
- B. The Design Professional shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment.
- C. Mechanical Contractor. The mechanical contractor shall have the following training responsibilities:
  1. Provide the Design Professional with a training plan two (2) weeks before the planned training.
  2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, pumps, heat rejection equipment, units, air handling units, fans, terminal units, controls and water treatment systems, etc.
  3. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.
  4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
  5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment is required. More than one party may be required to execute the training.

6. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
8. Training shall include:
  - a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
  - b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.
  - c. Discussion of relevant health and safety issues and concerns.
  - d. Discussion of warranties and guarantees.
  - e. Common troubleshooting problems and solutions.
  - f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
  - g. Discussion of any peculiarities of equipment installation or operation.
  - h. The format and training agenda in *The HVAC Commissioning Process, ASHRAE Guideline 1-1989R*, 1996 is recommended.
  - i. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
9. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance for all pieces of equipment.
10. The mechanical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not *controlled* by the central control system.
11. Training shall occur after functional testing is complete.

D. Controls Contractor. The controls contractor shall have the following training responsibilities:

1. Provide the Design Professional with a training plan four weeks before the planned training.
2. The controls contractor shall provide designated Owner personnel training on the control system in this facility. The intent is to clearly and completely instruct the Owner on all the capabilities of the control system.
3. Training manuals. The standard operating manual for the system and any special training manuals will be provided for each trainee, with three (3) extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three (3) copies submitted with the O&M manuals. Manuals shall include detailed description of the subject matter for each session. The manuals will cover all control sequences and have a definitions section that fully describes all relevant words used in the manuals *and* in all software displays. The Design Professional will approve manuals. Copies of audiovisuals shall be delivered to the Owner.
4. The trainings will be tailored to the needs and skill-level of the trainees.

5. The trainers will be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer will be used. The Owner shall approve the instructor prior to scheduling the training.
6. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
7. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
8. There shall be three training sessions:
  - a. Training I. Control System. The first training shall consist of 8 hours of actual training. This training may be held on-site or in the supplier's facility. If held off-site, the training may occur prior to final completion of the system installation. Upon completion, each student, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
  - b. Training II. Building Systems. The second session shall be held on-site for a period of 8 hours of actual hands-on training after the completion of system commissioning. The session shall include instruction on:
    - 1) Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.
    - 2) Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
    - 3) All trending and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends. Trainees will actually set-up trends in the presence of the trainer.
    - 4) Every screen shall be completely discussed, allowing time for questions.
    - 5) Use of keypad or plug-in laptop computer at the zone level.
    - 6) Use of remote access to the system via phone lines or networks.
    - 7) Graphics generation
    - 8) Point database entry and modifications
    - 9) Understanding DDC field panel operating programming (when applicable)
  - c. Training III. The third training will be conducted on-site six (6) months after occupancy and consist of 6 hours of training. The session will be structured to address specific topics that trainees need to discuss and to answer questions concerning operation of the system.

- E. TAB Contractor. The TAB contractor shall have the following training responsibilities:

1. TAB shall meet for 4 hours with facility staff after completion of TAB and instruct them on the following:
  - a. Go over the final TAB report, explaining the layout and meanings of each data type.
  - b. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
  - c. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
  - d. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
  - e. Other salient information that may be useful for facility operations, relative to TAB.

END OF SECTION 230800

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## SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS, REQUIRED COORDINATION/CLARIFICATIONS

- A. Drawings and General Provisions of the contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. All work of this Section shall be coordinated and provided by the single Building Management System (BMS) Sub-Contractor.
- C. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other sections/trades. Reference the Division 23 and Division 26 Sections for details.
- D. The work of this Section shall be as required by the Specifications, Drawings, Point Schedules, Sequences of Operation and Mechanical Systems Commissioning activities.
- E. The contract documents and the sequences of operation are for conveying general concept only and are not meant to be inclusive of all hardware requirements or all functional sequence requirements. Refer to the complete package of contract drawings. Items mentioned in Sections 230900 and 230993, shown on the contract documents, mentioned in the sequences of operation, or shown on other HVAC drawings shall become part of the work of this project without the necessity of being separately detailed in each of those applicable sections of the contract documents. Reference in one section of the contract documents shall be interpreted to include reference in all other applicable sections. Any additional hardware and/or software required to accomplish functional intent shall be provided (without additional cost to the owner) just as though it were fully detailed throughout the contract documents.
- F. Freezestats and fan static safety switches shall be automatic reset type terminal devices.
- G. Freezestat, fan static, smoke detector, etc. safeties shall be both hardwired to their associated starter or VFD and wired as an input to the BMS. Each safety shall be wired to its associated BMS controller I/O panel to operate a discrete multi-pole relay. Each safety shall be wired as normally closed and energize its associated multi-pole relay coil under normal conditions. One set of relay contacts shall be wired as an input into the BMS to provide safety status. Another set of contacts shall be series hardwired with the other associated fan safeties to provide a fan system hardwired safety shut-down.
- H. Local displays will be provided for all building controllers and advanced application controllers.

- I. The points lists indicate hardwired monitoring/control points for each VFD. In addition, each new VFD shall make available to the BMS, via the drive communication interface, the full list of available performance parameters for inclusion as part of the graphic display data for the VFD. The BMS Contractor shall be responsible for implementing BACnet communication to the new VFDs and integrating the full list of available performance parameters as part of the BMS database. New VFDs shall be provided with BACnet communication capability fully implemented.
- J. Each product or group of products manufactured by a different manufacturer, that is to be connected to the BMS via a BACnet MS/TP communication interface, shall be placed on its own separate dedicated communication bus that originates at a network controller and is extended and connected to only the identical product operating at identical communication protocol and communication speeds. Additional network router/controller(s) shall be utilized, if necessary, to accomplish this communication interface segregation.
- K. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team prior to the submission of bids.
- L. Where conflict exists among sections 230900 and 230993 and the contract drawings, and questions were not raised during the bidding period to obtain clarification, the most stringent interpretation shall apply thereafter.
- M. The listing of specific manufacturers hereinafter does not imply acceptance of their products that do not meet the specified construction, performance, feature and function requirements. Listed manufacturers are not relieved from meeting these specifications in their entirety.
- N. The BMS shall monitor all applicable (as determined by the Professional) points available through the various equipment/system communication interfaces and VFD communication interfaces defined by Sections 230900 and 230993 and treat those data points as BMS database entries for purposes of graphic display, trending, alarming, etc.
- O. AHU smoke damper, fire/smoke damper, and/or control/fire/smoke damper end switch statuses shall be monitored directly by the BMS system. The end switch statuses shall be used by the BMS system as required to provide monitoring, alarming and trending of damper positions of the associated systems. Where the BMS points list indicates monitoring of these damper 'open' and 'closed' positions, end switches wired to coils of double pole double throw relays are required. The relays shall be provided in order to provide one set of dry contact outputs for use by the fire alarm system and the other set of dry contacts for use by the BMS contractor. The BMS contractor shall furnish, install and wire the necessary enclosure mounted relays at close proximity to the end switch locations. The BMS contractor shall provide power for powering the relay coils and wire the power through the damper end switches to operate the relay coils. The BMS Contractor shall wire one set of dry contact outputs to the BMS. The Electrical Contractor shall wire the second set of dry contact outputs to the Fire Alarm System.
- P. The BMS contractor shall visit the site, prior to submitting a bid, and fully acquaint himself with the scope of the project. In that there are no existing control drawings for much of the hybrid installation, this site visit should be used to verify all existing conditions that will become part of the work of this project.

- Q. Work in occupied areas: All work outside of mechanical and electrical equipment rooms/areas shall be accomplished during “off hours” when the spaces are unoccupied. The Contractor shall be responsible for restoring suitable conditions, as defined by the owner, prior to the start of the next occupied cycle.

1.2 PRODUCTS NOT FURNISHED OR INSTALLED BY, BUT INTEGRATED WITH THE WORK OF, THIS SECTION

A. General:

1. Coordination Meeting: The BMS Contractor shall meet with the supplier(s) furnishing each of the following products to coordinate details of the interface between these products and the BMS network. The Owner or his designated representative shall be present at this meeting. Each supplier shall provide the Owner and the BMS Contractor with details of the proposed interface including PICS for BACnet equipment, hardware and software identifiers for the interface points, network identifiers, wiring requirements, communication speeds, and required network accessories. The purpose of this meeting shall be to insure there are no unresolved issues regarding the integration of these products into the BMS network. Submittals for these products shall not be approved prior to the completion of this meeting.

B. Communications with Third Party Equipment:

1. New variable frequency drives shall be furnished with a BACnet interface for integration into the BMS System.
2. The Fire Alarm System (FAS) shall provide dry contact closure for device monitoring and control by the BMS System.

1.3 BMS DESCRIPTION

- A. It is the intent of this project to provide a web accessible, interoperable Building Management System (BMS) based on server/thin client architecture, with support for multiple communication protocols, and designed around the open standards of web technology. In addition to other capabilities described hereinafter, the BMS shall include full programmability of all connected nodes (controllers provided by the BMS Contractor) via the web for an authorized user. The BMS shall also include implemented override capability of all controller outputs (for controllers provided by the BMS Contractor) via the web for an authorized user. An authorized user shall also be able to create/edit graphic screens, trends and alarms without the need for any additional hardware and/or software. Coordinate with the Owner's IT department for Ethernet communication cabling and TCP/IP addresses. Ethernet drops shall be provided by the owner.
- B. The entire BMS network shall be fully functional for the start-up, check-out and commissioning processes. In order to achieve that end result, the BMS Contractor shall provide all temporary Ethernet infrastructure necessary for full operation of the BMS network prior to availability of the owner's Ethernet network. The BMS Contractor shall complete changeover to the owner furnished network and remove any temporary infrastructure when the owner's network is made available for use by the BMS.

- C. The BMS shall be designed and installed for use with the enterprise (Owner's) IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BMS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.
- D. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.
- E. Servers shall be used for the purpose of providing a location for extensive archiving of system configuration data, and historical data such as trend data and operator transactions. All data stored will be through the use of a standard data base platform: Microsoft SQL Server.
- F. The work of the BMS Contractor shall be as defined individually and collectively in all Sections of this Division specification together with the associated Point Lists and Drawings, Sequences of Operation and the associated interfacing work as referenced in the related documents.
- G. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.
- H. The BMS Contractor shall have on-site personnel capable of making programming changes and graphics changes to the BMS throughout the commissioning process.
- I. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.
- J. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:
  - 1. Operator information, alarm management and control functions.
  - 2. Enterprise-level information and control access.
  - 3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
  - 4. Diagnostic monitoring and reporting of BMS functions.
  - 5. Offsite monitoring and management access.
  - 6. Energy management
  - 7. Standard applications for terminal HVAC systems.
  - 8. Mechanical and Electrical System Integration with the BMS
  - 9. Trending. Trend sample intervals shall be coordinated with the Commissioning Agent.
  - 10. Indoor Air Quality monitoring and control

- K. All controllers (provided by the BMS Contractor) shall be fully field programmable by the owner to allow for field customization, both now and in the future, to meet the owner's exact control strategy requirements and address ongoing changes in those requirements. In addition, an authorized user shall also be able to create/edit graphic screens, trends and alarms, upload/download NAE/NCE, Field Equipment Controllers, Input/ Output Modules, Variable Air Volume Box Controller and Networked Thermostat Controller databases, monitor all BACnet Objects including but not limited to Analog and Digital Inputs/Outputs/Values, monitor and override all controller physical input/output points, and edit controller resident time schedules, all without the need for any additional vendor interaction. All hardware and software tools and accessories required to provide the owner with these capabilities shall be furnished as part of this project. NO EXCEPTIONS
- L. As soon as a BMS DDC controller is placed into operation, whether temporary or permanent, it shall be connected to the Dedicated Web Based User Interface, the Distributed Web Based User Interface and the Network Automation Engine which have already been placed into complete operation with complete functionality for each installed DDC controller. This shall include the installation of the high speed internet service, connection, wiring and devices; all required Ethernet network wiring and devices and all required BMS communication network wiring and devices for each segment placed into operation whether infrastructure is installed temporarily or permanently until such time the complete system can be permanently installed.
- M. All access codes, passwords and logins shall be as per the owner requirements. The owner shall not be locked out of any portion of the system or network. NO EXCEPTIONS.
- N. All hardware and software shall be provided with required licensing registered under the Owners name, valid for the life of the project. The licensing shall provide the owner the ability to allow unrestricted access and reprogram ability to whomever the owner provides system access to.
- O. The BMS Contractor shall provide a full complement of software tools and associated training (and hardware where software keys or other proprietary devices are involved) for use by the Commissioning Agent. The Commissioning Agent shall return all software and hardware tools to the BMS Contractor at the end of the Commissioning Agent's involvement with the project.
- P. The BMS Contractor shall provide separate MSTP buses for each grouping of DDC controllers and associated devices so that each controller/device shall communicate at its maximum rated communication baud rate. Down grading the communication speed of a controller/device so it can reside on an MSTP bus with slower communicating controllers/devices is not acceptable.

- Q. Where a unit is provided with manufacturer furnished (factory) controls, the unit manufacturer shall be responsible for evaluating the requirements of the contract documents sequences of operation and defining the read/write operations between the BMS and the factory controls that will be required in order to implement those sequences. Where the BMS vendor will be required to provide/install field hardware to supplement the factory controls, the unit manufacturer will be responsible for providing that information to all BMS vendors listed in the project specifications no later than five (5) days before the bid due date. The manufacturer's control engineer shall meet (telephone conference calls will be acceptable) with the BMS vendor's application programmer, in the presence of the Professional, to define and coordinate those read/write communication requirements and provide a hardcopy record for the project O & M Manuals. The Professional shall continue those discussions as necessary in order to establish that both parties understand their responsibilities in relation to the final working product. Should this coordination not take place, the unit manufacturer shall be responsible for reimbursing the Professional, at standard billing rates, for all time spent researching any field start-up, check-out and commissioning problems that are traced to a lack of the prerequisite coordination defined above.
- R. The unit manufacturer shall be responsible for determining that the factory controls, with proper communication to/from the BMS, are capable of implementing the sequences of operation as defined by the contract documents. Results that merely "approximate the intent" of the required sequences of operation are not acceptable. NO EXCEPTIONS. In addition, the unit manufacturer shall be responsible for maintaining the read/write coordination requirements, as defined for the initial construction process, throughout a ten (10) year period that begins with the start of the warranty period. Any updates to the factory controls during this ten (10) year period shall not require any reprogramming on the part of the BMS vendor. Should any reprogramming be required by the BMS vendor, the unit manufacturer shall be responsible for reimbursing the BMS vendor, at standard billing rates, for all time spent to accomplish the required reprogramming.

#### 1.4 QUALITY ASSURANCE

##### A. General

1. The Building Management System (BMS) Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems. Throughout this specification, any reference to "ATC Contractor", "BAS Control Contractor", "Controls Contractor" or "local field office" shall be interpreted as referring to the Building Management System (BMS) Contractor.
2. The term "manufacturer" when used to identify an automatic temperature control sub-contractor/supplier, shall mean the complete system of building energy management. Components of the completed system shall include but not being limited to, hardware equipment, engineering, wiring, installation, sequence of operations, network architecture, commissioning, training, software programming and warranty.
3. The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.
4. Franchised dealers, or HVAC Contractors installing their own controls will not be accepted. NO EXCEPTIONS.
5. The BMS Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.

6. As evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the contractor must have been in the BMS business for at least the last ten (10) years.
7. The Building Management System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems and shall be the manufacturer's latest standard of design at the time of bid.

B. Workplace Safety and Hazardous Materials

1. Provide a safety program in compliance with the Contract Documents.
2. The BMS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.
3. The Contractor and its employees and subtrades comply with federal, state and local safety regulations.
4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that cover their scope of work, and that their employees receive the training required by the OSHA having jurisdiction for at least each topic listed in the Safety Certification Manual.
5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.
6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.
8. The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the Authority Having Jurisdiction (AHJ) at the Project site.
9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Quality Management Program

1. Designate a competent and experienced employee to provide BMS Project Management. The designated Project Manager shall be empowered to make technical, scheduling and related decisions on behalf of the BMS Contractor. At minimum, the Project Manager shall:
  - a. Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.
  - b. Manage the financial aspects of the BMS Contract.
  - c. Coordinate as necessary with other trades.
  - d. Be responsible for the work and actions of the BMS workforce on site.

1.5 REFERENCES

- A. All work shall conform to the following Codes and Standards, as applicable:

1. National Fire Protection Association (NFPA) Standards.
2. National Electric Code (NEC) and applicable local Electric Code.
3. Underwriters Laboratories (UL) listing and labels.
4. UL 864 UUKL Smoke Control
5. UL 268 Smoke Detectors.
6. UL 916 Energy Management
7. NFPA 70 - National Electrical Code.
8. NFPA 90A - Standard for The Installation of Air Conditioning And Ventilating Systems.
9. American National Standards Institute (ANSI).
10. National Electric Manufacturer's Association (NEMA).
11. American Society of Mechanical Engineers (ASME).
12. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) and ASHRAE 62 IAQ as applicable.
13. Air Movement and Control Association (AMCA).
14. Institute of Electrical and Electronic Engineers (IEEE).
15. American Standard Code for Information Interchange (ASCII).
16. Electronics Industries Association (EIA).
17. Occupational Safety and Health Administration (OSHA).
18. American Society for Testing and Materials (ASTM).
19. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
20. Americans Disability Act (ADA)
21. ANSI/ASHRAE Standard 195-2004 (BACnet)

B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.

C. All work shall meet the approval of the Authorities Having Jurisdiction (AHJ) at the project site. The BMS vendor shall be responsible for gaining BMS system approval from the AHJ.

## 1.6 SUBMITTALS

### A. Shop Drawings, Product Data, and Samples

1. The BMS contractor shall submit shop drawings within 90 days of contract award. Shop drawing submittal shall be complete for the full scope of the project work and shall be provided as ONE COMPLETE PACKAGE. Package shall include the work of Sections 230900 and 230993 in order to verify integrated performance requirements. Partial or incomplete submittals shall be returned unchecked.
2. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
3. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
4. The BMS Contractor shall correct any errors or omissions noted in any review submission.



5. Shop drawing submittals shall be complete and fully detailed so as to establish all required information to provide a fully engineered, coordinated and integrated distributed processing HVAC/LAFCS control system. All terminal-to-terminal and one line wiring diagrams and flow diagrams shall be submitted in AUTOCAD or VISIO format (latest version). At a minimum, submit the following:
  - a. Complete BMS network architecture diagrams including all nodes, interconnections and interface to nodes not provided by the BMS contractor but a BMS communication interface required. BMS network architecture shall detail each controller, controller ID, controller location, system served, communication buses and type associated, sub-busses with connected sub-systems, etc. BMS network architecture diagrams shall include communication speeds for each bus segment.
  - b. Sequentially numbered systems schematics, sequences and flow diagrams with an index identifying pages for each drawing for the project.
  - c. Provide a schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, it shall be labeled with the same name. All terminals shall be labeled.
  - d. Provide an instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer and model number.
  - e. Include a complete description of the operation of the control system, including sequences of operation. The description shall include a schematic diagram of the controlled system.
  - f. Provide a point list for each system controller including both input and output (I/O) points, point number, the controlled device associated with the I/O point, and the location of the I/O device.
  - g. Samples of Graphic Display screen types and associated menus for each type of equipment on this project.
  - h. Control Damper Schedule including a separate line for each damper provided and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
  - i. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes including, but not limited to: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close-off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.
  - j. Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address and room thermostat specifics.
  - k. Details of all BMS interfaces and connections to the work of other trades.
  - l. Listing of all read and or write points derived via interfaces to mechanical system components as required per project specifications, sequences of operation, points list(s), and/or required for correct systems operation and functionality. Points shall be identified as to point type (AI, DI, AO, DO, AV, BV), point source (read, write, commandable), interface type (Lon, BACnet, N2, etc.) point ID in BMS and point ID in mechanical system, mechanical system source (VFD, RTU, Chiller, etc.), point (object) name (% speed, fan status, cws temp, etc.) and point description (speed of motor, fan on, chilled water supply temperature, etc.)

- m. Sequentially numbered product data sheet section with an index identifying page(s) for each product utilized in the installed BMS system and product data sheet(s) for each product. The index shall individually list each product with the associated numerically sequenced page number(s) of the product data sheets. For all products including software, provide product data sheet(s) or marked catalog pages that include part number, photo, complete specifications and numerically sequenced page number(s) referenced in the index. Where product data sheets apply to multiple devices, those devices specific to this project shall be clearly highlighted for ease of reference to the appropriate data. Failure to provide this highlight requirement shall cause the submission to be interpreted as an incomplete submittal which shall follow the rules for partial or incomplete submittals defined above.
- 6. All submittals, “as-builts” and O & M Manuals shall clearly indicate the location of all controllers and field devices (in Room 123, above corridor ceiling outside Room 456, etc.)
- 7. Existing ‘as-built’ drawings shall be completely updated to reflect integration of the work of this project and submitted as part of the shop drawings.

## 1.7 RECORD DOCUMENTATION

### A. Operation and Maintenance Manuals

- 1. Six (6) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BMS provided:
  - a. Table of contents.
  - b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
  - c. Manufacturer's product data sheets or catalog pages for all products including software. Where product data sheets apply to multiple devices, those devices specific to this project shall be clearly highlighted for ease of reference to the appropriate data.
  - d. System Operator's manuals.
  - e. Archive copy of all site-specific databases and sequences.
  - f. BMS network diagrams.
  - g. Interfaces to all third-party products and work by other trades.
- 2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

3. The Controls Contractor shall provide O & M manuals that are organized in a logical, concise easy to use format. Where changes have occurred from the original submittal package, those changes shall be reflected on the appropriate unit/system/sub-system drawings and not just grouped as a series of partial drawings (i.e. changes only) at the end of the drawing package. In like fashion, new terminal devices shall be logically inserted into the specification data sheet sections according to the type of device(s) involved and not just grouped as a series of new pages at the end of the previous data sheet submittal section. In addition, the BMS overview drawings shall accurately reflect “as-built” conditions, including the integration of communication nodes provided by other manufacturers/trades. To the extent that the original submittal package must be totally redone in order to satisfy these requirements, the Controls Contractor shall make the necessary changes at no additional cost to the owner.
4. All submittals, “as-builts” and O & M Manuals shall clearly indicate the location of all controllers and field devices (in Room 123, above corridor ceiling outside Room 456, etc.)
5. Existing “O & M Manuals” shall be modified as required to reflect integration of the work of this project and submitted as part of the shop drawings.

## 1.8 WARRANTY

### A. Standard Material and Labor Warranty:

1. Provide a two-year labor and material warranty on the BMS.
2. The local field office shall warranty all BMS computers, controllers, software and related I/O equipment and all new pneumatic and electric hardware for a period of two (2) years from the date of final payment.
3. All equipment found to have defects in material or workmanship during this warranty period shall be replaced at no charge to the Owner with equipment of equal type and quality by the local field office. All labor required during the warranty period shall also be included, with the following clarification. Materials furnished but not installed by the BMS contractor shall be covered to the extent of the product only. Installation labor shall be the responsibility of the trade contractor performing the installation.
4. Operator workstation software updates, project-specific software updates, graphic software updates, database software updates, and firmware updates which resolve known deficiencies as identified by the local field office and/or Owner shall be provided to the Owner at no charge during the warranty period. The local field office shall also keep current with manufacturer’s software and firmware updates for the Owner’s BMS during the warranty period at no charge to the Owner.
5. The Contractor shall respond to the job site within a 24 hour period for any warranty work relating to the control system.
6. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming, occurs in a timely manner. Warranty work shall be done during BMS Contractor’s normal business hours.

## PART 2 – PRODUCTS

### 2.1 STANDARD OF QUALITY

- A. It is recognized that the BMS design for this project, both hardware and software, represents a specific approach to addressing both owner ease of operation and long term energy efficiency of the completed HVAC project. To that end, this specification clearly establishes MINIMUM hardware, software, installation, commissioning and man-machine interface requirements. While it is clear that there may be distinctions in how different ATC manufacturers configure their hardware and software approaches/solutions for this project, it must be pointed out that this specification establishes MINIMUM STANDARDS APPLICABLE TO ALL named manufacturers. Named manufacturers should not assume that just because they are named as an acceptable manufacturer, they can use lower level hardware and/or software components to meet the functional intent of this specification. Where necessary, because a lower level panel or terminal device fails to satisfy ALL of the specification requirements, manufacturers shall use higher level hardware to satisfy specification requirements, even if all requirements are exceeded in the process. It remains the intent of this specification to require GREATER THAN OR EQUAL TO COMPLIANCE from all manufacturers for all BMS system components as well as I/O devices.
- B. The network architecture described hereinafter is that of the basis of design manufacturer and describes open protocol BACnet communication requirements at both the automation network level and the field controller network level. For named manufacturers who do not offer a BACnet solution at the controller level, use of LON controllers or proprietary controllers at the field controller network level is acceptable. However, all named manufacturers shall be required to utilize BACnet communications at the automation network level. NO EXCEPTIONS.

## 2.2 GENERAL DESCRIPTION

- A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.
- B. The system shall be a standard product with the manufacturer who will guarantee ongoing parts availability and factory trained field support for ten (10) years after system acceptance.
- C. The Building Management System shall consist of the following:
  - 1. Network Automation Engine(s)
  - 2. Network Control Engine(s), as required
  - 3. Network Integration Engine(s), as required
  - 4. Field Equipment Controller(s)
  - 5. Input/ Output Module(s)
  - 6. Application Specific Controllers
  - 7. Local Display Device(s)
  - 8. Distributed User Interface(s)
  - 9. Network processing, data storage and communications equipment
  - 10. Graphical Programmer
  - 11. Graphical User Interfaces (GUI)
  - 12. Ready Access Portal
  - 13. Portable Operator's Terminal (POT)

14. Workstation Server Hardware Station (existing to be upgraded)
  15. Other components required for a complete and working BMS
- D. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.
- E. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
- F. Acceptable Manufacturers
1. Johnson Controls - Basis of Design
  2. Automated Logic
  3. Siemens
  4. Control Systems Inc. (Schneider Electric)
- G. The BMS contractor shall supply to the Professional a subparagraph by subparagraph specification compliance report. The compliance report shall address the requirements of both Section 230900 and Section 230993. As a minimum, the report shall indicate for each numbered subparagraph identified with a capital letter whether the Contractor meets the criteria of the subparagraph. (Where exceptions and/or non-compliance are involved, and additional levels of subparagraphs exist, it shall be necessary to go to the next level(s) of subparagraph(s) to provide the appropriate information.) Failure to heed this compliance report requirement, to the minimum level of detail specified, shall be interpreted to mean that the given BMS fails to meet the specified criteria and/or intent and the associated bid may be rejected. NO EXCEPTIONS. The following format must be utilized in completing the compliance report:
1. Comply - without exception
  2. Exception - Meet the functional intent. For each paragraph/subparagraph, the Contractor shall identify all differences in specific functions stated in the given paragraph/subparagraph and provide a description of what is excluded or how he intends to meet the function specified.
  3. Does Not Comply - Cannot meet specified function and will not provide.
- H. The BMS Contractor is hereby warned against indicating compliance with a given specification item at compliance report time and subsequently including a different non-compliant item at submittal time. References to "industry standard practices" shall not constitute a justification for such a change. Any deviations from the original specification compliance report, a copy of which shall be included with the shop drawing submittal, will not be accepted by the Professional. In addition, all "exceptions" and "does not comply" responses shall be explained in sufficient detail to allow the Professional to evaluate the economic impact of the difference and judge if the impact creates an unfair advantage when pricing alone is the sole evaluation criteria for the overall system. The Professional reserves the right to require full unconditional compliance with any and all items deemed necessary and/or in the best interest of the project. All submittal data shall clearly indicate sufficient technical information to readily determine specification compliance.

- I. The Specification Compliance Report will be reviewed by the Professional and named manufacturers who fail to establish “greater than or equal to” system design and performance may have their name removed by addendum.
- J. The substitution provisions of other Sections of these specifications shall not be applicable to the work of these Sections – Instrumentation and Control for HVAC and Sequences of Operation for HVAC Controls. NO SUBSTITUTIONS. NO EXCEPTIONS.
- K. The system shall be a standard product with the manufacturer who will guarantee ongoing parts availability and factory trained field support for ten (10) years after system acceptance.
- L. The BMS Contractor shall provide project specific BMS architecture overview diagram as part of his bid. The architectural overview shall begin with the owner provided network and include all servers/workstations, a riser-type diagram of all Ethernet switches and hardware panels utilized on the project, including 3<sup>rd</sup> party equipment being interfaced to the BMS, at each communication bus level. Quantities and model numbers of the controllers involved shall be clearly indicated in order to facilitate evaluation of the proposed hardware solution in light of specification requirements. Specification data sheets for all controllers shall also be included. Overview diagram shall clearly indicate ALL network communication protocols used in the system for this specific project and the baud rate for each communication bus segment.

## 2.3 BMS ARCHITECTURE

### A. Automation Network

- 1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard “off the shelf” products available through normal PC vendor channels.
- 2. The BMS shall network multiple user interface clients, automation engines, control engines, system controllers and application-specific controllers. Provide application and data server(s) as required for systems operation.
- 3. The automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
- 4. Network Automation Engines (NAE) and Network Control Engines (NCE) shall reside on the automation network.
- 5. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.
- 6. BMS Contractor shall be responsible for providing all labor and materials for implementing any portion of the automation network level required for this project that is not provided by the owner.

### B. Control Network

- 1. Network Automation Engines and Network Control Engines shall provide supervisory control over the control network and shall support the following communication protocol:
  - a. BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9.

2. Control networks shall provide either “Peer-to-Peer,” Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
3. DDC (FEC) Controllers shall reside on the control network.
4. Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
5. A BACnet Protocol Implementation Conformance Statement shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.
6. BMS Contractor shall be responsible for providing all labor and materials for implementing control network level required for this project.

C. Integration

1. BACnet Protocol Integration – BACnet
  - a. The neutral protocol used between systems will be BACnet over Ethernet and comply with the ASHRAE BACnet standard 195-2004.
  - b. A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.
  - c. The ability to command, share point object data, change of state (COS) data and schedules between the host and BACnet systems shall be provided.
  - d. Any/all routers, switches, hubs and CAT 6 wiring required to implement BMS and/or integration to other systems shall be the responsibility of the BMS contractor to furnish and install. All power and material required for operation of associated routers, switches and hubs shall be furnished and installed by the BMS contractor from panels with spare circuit locations as approved by the Professional.
2. The Building Management System (BMS) shall utilize auxiliary contacts from room occupancy sensors where applicable.
  - a. The BMS system shall read occupancy sensor statuses to provide “Standby Mode” HVAC equipment operation during an Occupied Schedule.
3. The Fire Alarm System (FAS) shall communicate with the Building Management System (BMS) via a dry contact closure from fire alarm system devices. The FAS shall make smoke detector status information, smoke or smoke-fire damper end switch status information, smoke or smoke-fire damper PAM status information and ZAM status information available via this interface.
4. Typical VFD communication interface points shall include:

BV	Fan VFD Status
BV	Fan VFD Fault Condition ~
AV	Fan VFD Motor Speed (RPM)
AV	Fan VFD Speed Setpoint (Hertz)
BV	Fan Motor Failure ~
BV	Fan Motor Runtime *
BV	Fan Minimum Runtime Exceeded ~
AV	Fan VFD Output Speed (Hertz)
AV	Fan VFD Motor Kilowatt Hours
BV	Fan VFD in “Auto” ~

BV Fan VFD in “Off” ~  
BV Fan VFD in “Hand” ~  
BV Fan VFD Over Current ~  
BV Fan VFD Over Voltage ~  
BV Fan VFD Under Voltage ~  
BV Fan VFD Ground Fault ~  
BV Fan VFD Input Line Supervision ~  
BV Fan VFD Output Phase Supervision ~  
BV Fan VFD Under Temperature ~  
BV Fan VFD Over Temperature ~  
BV Fan Motor Stalled ~  
BV Fan VFD External Fault ~  
BV Fan VFD Communication Bus Failure ~

## 2.4 USER INTERFACE

### A. Dedicated Web Based User Interface

1. The BMS Contractor shall provide and install personal computers for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation/Control Engines to facilitate greater fault tolerance and reliability. ADS/ADX Site Director software package shall be installed on appropriate PC platform by the BMS Contractor.
2. Dedicated User Interface Architecture – The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third-party applications suppliers, including but not limited to Microsoft Office Applications. Specifically, it must be implemented to conform to the following interface standards.
  - a. Microsoft Internet Explorer for user interface functions
  - b. Microsoft Office Professional for creation, modification and maintenance of reports, sequences and other necessary building management functions
  - c. Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports
  - d. Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries.
3. PC Hardware –
  - a. One (1) Personal Computer operator workstation, where indicated on the drawings, to provide for command entry, information management, system monitor, alarm management and database management functions. Shall be configured as follows subject to final approval by owner’s IT group:
    - Memory – 8 GB RAM
    - CPU – Pentium processor with minimum 3.0 GHz Clock Speed
    - Hard Drive – 120 GB free hard drive space
    - Hard drive backup system – CD/RW, DVD/RW or network backup software provided by IT department



- Ports – (2) Serial and (1) parallel, (2) USB ports minimum
  - Data Entry – 101-key enhanced keyboard and 2-Button Mouse
  - Monitor - flat panel type and shall support a minimum display resolution of 1280 × 1024 pixels. The display shall have a minimum of 17" visible area in diagonal measurement. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.
  - LAN communications – Ethernet communications board; 3Comm or equal.
- b. Furnish one (1) laptop computer with full BMS functionality for maintenance purposes.
  - c. The Owner will provide additional information from its IT group regarding the specifications for computers, laptops and servers.
4. Operating System Software
- a. Microsoft Windows
  - b. Where user interface is not provided via browser, provide complete operator workstation software package, including any hardware or software keys. Include the original installation disks and licenses for all included software, device drivers, and peripherals.
  - c. Provide software registration cards to the Owner for all included software.
5. Peripheral Hardware
- a. Reports printer shall be provided for each operator workstation and shall be provided with minimum configuration as follows:
    - Printer Make – Hewlett Packard DeskJet
    - Print Speed – 600 DPI Black, 300 DPI Color
    - Buffer – 64 K Input Print Buffer
    - Color Printing – Include Color Kit
- B. Distributed Web Based User Interface
- 1. All features and functions of the dedicated user interface previously defined in this document shall be available on any computer connected directly or via a wide area or virtual private network (WAN/VPN) to the automation network and conforming to the following specifications.
  - 2. The software shall run on the Microsoft Internet Explorer browser.
- C. User Interface Application Components
- 1. Operator Interface
    - a. An integrated browser based, client application shall be used as the user operator interface program.
    - b. All Inputs, Outputs, Setpoints, and all other parameters as defined by the contract documents, or required as part of the system software, shall be displayed for operator viewing, modification, and/or override from the operator interface software.

- c. The user interface software shall provide help menus and instructions for each operation and/or application.
- d. All controller software operating parameters shall be displayed for the operator to view/modify from the user interface. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.
- e. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:
  - User access for selective information retrieval and control command execution
  - Monitoring and reporting
  - Alarm, non-normal, and return to normal condition annunciation
  - Selective operator override, and other control actions
  - Information archiving, manipulation, formatting, display and reporting
  - BMS internal performance supervision and diagnostics
  - On-line access to user HELP menus
  - On-line access to current BMS as-built records and documentation.  
Sequence of operation information, shop drawings and specifications data sheets associated with a system shall be available from the graphic screen associated with that system. This feature shall be fully implemented for the graphic screens created for this project.
  - Means for the controlled re-programming, re-configuration of BMS operation and for the manipulation of BMS database information in compliance with the prevailing codes, approvals and regulations for individual BMS applications.
- f. The operation of the control system shall be independent of the user interface, which shall be used for operator communications only. Systems that rely on an operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.

## 2. Navigation Trees

- a. The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.
- b. Provide the ability for the operator to add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.
- c. The navigation trees shall be “dockable” to other displays in the user interface such as graphics. This means that the trees will appear as part of the display but can be detached and then minimized to the Windows task bar or closed altogether. A simple keystroke will reattach the navigation to the primary display of the user interface.

## 3. Alarms

- a. Alarms shall be routed directly from Network Automation/Control Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed

to specific PCs and servers. The alarm management portion of the user interface shall, at the minimum, provide the following functions:

- Log date and time of alarm occurrence.
- Generate a “Pop-Up” window, with audible alarm, informing a user that an alarm has been received.
- Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
- Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.
- Provide the ability to direct alarms to an e-mail address, alphanumeric pager or cell phone text message. This must be provided in addition to the pop up window described above. Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable. BMS Contractor shall coordinate implementation of this feature with the owner as part of the work of this project.
- Any attribute of any object in the system may be designated to report an alarm.

- b. The BMS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions
- c. The BMS shall annunciate application alarms at minimum, as required by the Contract Documents.

#### 4. Reports and Summaries

- a. Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:
  - All points in the BMS
  - All points in each BMS application
  - All points in a specific controller
  - All points in a user-defined group of points
  - All points currently in alarm
  - All points locked out
  - All BMS schedules
  - All user defined and adjustable variables, schedules, interlocks and the like.
- b. Summaries and Reports shall be accessible via standard User interface (UI) functions and not dependent upon custom programming or user defined HTML pages.
- c. Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report or summary on the system printer for use as a building management and diagnostics tool.
- d. The system shall allow for the creation of custom reports and queries via a standard web services XML interface and commercial off-the-shelf software (provided as part of this project) such as Microsoft Access, Microsoft Excel, or Crystal Reports.

5. Schedules

- a. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
  - Weekly schedules
  - Exception Schedules
  - Monthly calendars.
- b. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.
- c. It shall be possible to define one or more exception schedules for each schedule including references to calendars.
- d. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days for a minimum of five years in advance. Holidays and special days shall be user-selected with the pointing device or keyboard and shall automatically reschedule equipment operation as previously defined on the exception schedules.
- e. Changes to schedules made from the User Interface shall directly modify the Network Automation/Control Engine schedule database.
- f. Schedules and Calendars shall comply with ASHRAE BACnet Standard.
- g. Selection of a single menu item or tool bar button shall print any displayed schedule on the system printer for use as a building management and diagnostics tool.

6. Password

- a. Multiple-level password access protection shall be provided to allow the user/manager to manage interface control, display, and database manipulation capabilities deemed appropriate for each user, based on an assigned password.
- b. Each user shall have the following: a user name (24 characters minimum), a password (12 characters minimum), and access levels.
- c. The system shall allow each user to change his or her password at will.
- d. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
- e. A minimum of five levels of access shall be supported individually or in any combination as follows:
  - Level 1 = View Data
  - Level 2 = Command
  - Level 3 = Operator Overrides
  - Level 4 = Database Modification
  - Level 5 = Database Configuration
  - Level 6 = All privileges, including Password Add/Modify
- f. A minimum of 100 unique passwords shall be supported.
- g. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.

- h. The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.
- 7. Screen Manager - The User Interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.
- 8. Dynamic Color Graphics
  - a. The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.
  - b. The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed. The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.
  - c. Graphics runtime functions – A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:
    - All graphics shall be fully scalable
    - The graphics shall support a maintained aspect ratio.
    - Multiple fonts shall be supported.
    - Unique background shall be assignable on a per graphic basis.
    - The color of all animations and values on displays shall indicate the status of the object attribute.
  - d. Operation from graphics – It shall be possible to change values (setpoints) and states in system controlled equipment by using drop-down windows accessible via the pointing device
  - e. Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations and defining all runtime binding.
    - The graphic editing tool shall in general provide for the creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required.
    - In addition, the graphic editing tool shall be able to add additional content to any graphic by importing backgrounds in the SVG, BMP or JPG file formats.
  - f. Aliasing – Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the physical field tags.
- 9. Historical trending and data collection

- a. Each Automation/Control Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
    - Any point, physical or calculated, may be designated for trending. Two methods of collection shall be allowed: defined time interval and upon a change of value
    - Each Automation/Control Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.
  - b. Trend and change of value data shall be stored within the engine and uploaded to a dedicated trend database or exported in a selectable data format via a provided data export utility. Uploads to a dedicated database shall occur based upon one of the following: user-defined interval, manual command, or when the trend buffers are full. Exports shall be as requested by the user or on a time scheduled basis.
  - c. All trend sample intervals shall be coordinated with the Commissioning Agent and shall be sufficient to support the needs of the commissioning process. All trend data required by the Commissioning Agent shall be provided by the BMS Contractor as part of the work of this project. NO EXCEPTIONS.
  - d. The system shall provide a configurable data storage subsystem for the collection of historical data. Data can be stored in either Microsoft Access or SQL database format.
10. Trend data viewing and analysis
- a. Provide a trend viewing utility that shall have access to all database points.
  - b. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.
  - c. The trend viewing utility shall have the capability to define trend study displays to include multiple trends
  - d. Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.
  - e. Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.
  - f. Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.
  - g. Trend studies shall be capable of calculating and displaying calculated variables including highest value, lowest value and time based accumulation.
11. BMS Contractor shall provide and install all computer hardware and software required for the purpose of configuration and consolidation of information and programs required for the delivery of a Task Focused, Web Based Portal to the BMS. This Ready Access Portal shall provide a natural, complementary extension to the site management user interface previously described and be fully implemented to the professional's satisfaction as part of the work of this project.
12. Ready Access Portal Architecture – The architecture of the system shall be implemented to conform to industry standards, so that it can accommodate the required applications provided by the BMS Contractor as well as communicate information to and from the Site Director.

13. Ready Access Portal User Interface Application Components

- a. The ready access portal shall provide an intuitive user interface to key BMS functions and tasks via web browser.
- b. Plug-ins or special software shall not be required for access to alarm, summary, schedule and trend data.
- c. The portal shall include the ability to view full graphical representations of systems and equipment on PC platforms
- d. The control system shall provide Secure Sockets Level (SSL) and Active Directory service support. If the Active Directory service and Single Sign-On features are enabled and the user is logged in to the Windows desktop, the login screen does not appear and access to the system is automatic.
- e. Provide a common tool for graphics creation, schedule creation, custom programming, user access and hardware definition.
- f. Information shall be accessible on both personal computer and handheld device platforms as follows:
  - Personal computers – Internet Explorer Version 7.0 recommended
  - Handheld devices – Internet Explorer for Window Mobile Version 5.0 or 6.0 recommended. UI is optimized for devices with a 240 x 320 pixel screen size (QVGA). Other devices may display the UI but full functionality is not guaranteed.

14. Ready Access Portal Operator Interface

- a. Password access shall be as described previously for management portal UI
- b. Once logged in, the System shall display a pre-selected screen tailored to the task requirements of the individual user.
- c. The User Interface shall utilize an intuitive navigation and display method designed for operators who access the system for casual information and control or on an infrequent basis. It shall feature three basic components.
  - Radio buttons for selection of the type of information to be displayed including Alerts, Summary, Schedules and Diagnostics
  - Navigation tree for selection of the specific data to be displayed on screen for the selected type. The navigation tree may be hidden and expanded by the operator to optimize the display of information
  - A display window that provides the selected information by type in a pre-configured tabular format
- d. The user interface software shall provide help menus and instructions for each operation and/or application.
- e. The system shall provide support for up to 100 concurrent users from an unlimited universe of individuals with defined password access to the system.
- f. The system shall utilize Secure Sockets Level (SSL) support as required to allow the ready access portal to communicate across a network in a way designed to prevent eavesdropping, tampering, and message forgery. It provides endpoint authentication and communications privacy over the network using cryptography.
- g. The system shall have the capability to display multiple navigation trees that correspond to the user views configured in the management portal UI.

- h. The alert summary of the remote access portal shall, at the minimum, provide the following information
  - Alert (Alarm) type
  - Date and time of alert occurrence
  - Priority (color coded to level)
  - Item name
  - Item value (if applicable)
  - Message
  - Any attribute of any object in the system may be designated to report an alarm
- i. A standard summary on the remote access portal shall, at the minimum, provide the following information
  - Point type graphic icon
  - Item name, value and status
  - Access to the Change Value window (if applicable) for the purpose of setting, holding or releasing an item value
- j. The schedule detail summary of the remote access portal shall, at the minimum, provide the following information
  - Scheduled occurrences including time and value
  - Scheduled overrides including start time, end time and value
  - A list of all scheduled items including name and attribute, value, status and priority
  - Access to the Add Temporary Override window for the purpose of adding a temporary override to the schedule
- k. The diagnostic (trend) summary of the remote access portal as viewed on a personal computing device shall provide the following information.
  - Item name
  - Item status
  - Trend name
  - Trend status
  - Full path name
  - Access to trend detail summary including trended value, time and date arranged in a user selectable format of 1 hour, 12 hours, 24 hours, 48 hours or 72 hours

## 2.5 CONTROL UNITS – GENERAL

- A. Provide an adequate number of control units to achieve monitoring and control of all data points specified and as necessary to satisfy the sequence of operation for all mechanical systems shown on the plans. Control units shall meet the following requirements.

- 1. Controllers shall be suitable for the anticipated ambient conditions.



- a. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at -40°F to 140°F and 5 to 95% RH (noncondensing). Heated enclosures shall be provided, if necessary, to meet specified performance.
  - b. Controllers used in conditioned ambient space shall be mounted in dust-proof enclosures and shall be rated for operation at 32°F to 122°F and 10 to 90% RH, (noncondensing).
2. Memory: The Control Units shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
3. Immunity to power and noise: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 ft.
4. Automatic staggered restart of field equipment after restoration of power and short cycle protection.
5. Powerfail Restart: Automatic staggered restart of field equipment, without manual intervention, after restoration of power and short cycle protection. In all cases, the controllers (both network level and field level) shall automatically resume proper operation following the return of power.  
In the event of a loss of communication, the Application Controller shall control from a standalone algorithm which maintains the assigned space temperature until communication is restored.
- B. Except as further defined hereinafter, the BMS Contractor shall provide controllers with unused Input/ Output capacity such that input/output points can be added to any controller to achieve additional point capacity of 15% for each type of point (AI, DI, AO, DO, PI) currently part of the input/output configuration.

## 2.6 NETWORK AUTOMATION ENGINES (NAE)

### A. Network Automation Engine

1. The Network Automation Engine (NAE) shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed FECs and application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation/Control Engines. NAE shall support the BACnet services and objects typically used by a workstation and a field controller device, including BACnet alarm and event services. NAE shall communicate via the MS/TP bus with the FEC family of BACnet application specific controllers (B-ASC).
2. Automation network – The NAE shall reside on the automation network and shall support a subnet of system controllers.
3. User Interface – Each NAE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.
  - a. The web based UI software shall be imbedded in the NAE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.
  - b. The NAE shall support a minimum of four (4) concurrent users.

- c. The web based user shall have the capability to access all system data through one NAE.
  - d. Remote users connected to the network through an Internet Service Provider (ISP) or telephone dial up shall also have total system access through one NAE.
  - e. Systems that require the user to address more than one NAE to access all system information are not acceptable.
  - f. The NAE shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the NAE.
  - g. Systems that support UI Graphics from a central database or require the graphics to reside on the user's personal computer are not acceptable.
  - h. The web based UI shall support the following functions using a standard version of Microsoft Internet Explorer:
    - Configuration
    - Commissioning
    - Data Archiving
    - Monitoring
    - Commanding
    - System Diagnostics
  - i. Systems that require workstation software or modified web browsers are not acceptable.
  - j. The NAE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.
4. Processor – The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of the Contract Documents.
5. Memory – Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
6. Hardware Real Time Clock – The NAE shall include an integrated, hardware-based, real-time clock.
7. The NAE shall include troubleshooting LED indicators to identify the following conditions:
- a. Power - On/Off
  - b. Ethernet Traffic – Ethernet Traffic/No Ethernet Traffic
  - c. Ethernet Connection Speed – 10 Mbps/100 Mbps
  - d. FC Bus A – Normal Communications/No Field Communications
  - e. FC Bus B – Normal Communications/No Field Communications
  - f. Peer Communication – Data Traffic Between NAE Devices
  - g. Run – NAE Running/NAE In Startup/NAE Shutting Down/Software Not Running
  - h. Bat Fault – Battery Defective, Data Protection Battery Not Installed
  - i. 24 VAC – 24 VAC Present/Loss Of 24VAC
  - j. Fault – General Fault
  - k. Modem RX – NAE Modem Receiving Data
  - l. Modem TX – NAE Modem Transmitting Data

8. Communications Ports – The NAE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator's terminals.
  - a. Two (2) USB ports
  - b. Two (2) RS-232 serial data communication ports
  - c. Two (2) RS-485 ports
  - d. One (1) Ethernet port
9. Diagnostics – The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.
10. Power Failure – In the event of the loss of normal power, the NAE shall continue to operate for a user adjustable period of up to 5 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.
  - a. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
  - b. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
11. Certification – The NAE shall be listed by Underwriters Laboratories (UL).
12. Controller network – The NAE shall support the following communication protocols on the controller network:
  - a. The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
    - A BACnet Protocol Implementation Conformance Statement shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.
    - The NAE shall support a minimum of 100 control devices.

## 2.7 DDC SYSTEM CONTROLLERS

### A. Field Equipment Controller

1. The Field Equipment Controller (FEC) with display shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol.
2. The FEC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.

3. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.
4. The FEC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
5. The FEC shall include a removable base to allow pre-wiring without the controller.
6. The FEC shall include troubleshooting LED indicators to identify the following conditions:
  - a. Power On
  - b. Power Off
  - c. Download or Startup in progress, not ready for normal operation
  - d. No Faults
  - e. Device Fault
  - f. Field Controller Bus - Normal Data Transmission
  - g. Field Controller Bus - No Data Transmission
  - h. Field Controller Bus - No Communication
  - i. Sensor-Actuator Bus - Normal Data Transmission
  - j. Sensor-Actuator Bus - No Data Transmission
  - k. Sensor-Actuator Bus - No Communication
7. The FEC shall accommodate the direct wiring of analog and binary I/O field points.
8. The FEC shall support the following types of inputs and outputs:
  - a. Universal Inputs - shall be configured to monitor any of the following:
    - Analog Input, Voltage Mode, 0 - 10 VDC
    - Analog Input, Current Mode, 4 – 20 mA
    - Analog Input, Resistive Mode
    - Binary Input, Dry Contact Maintained Mode
    - Binary Input, Pulse Counter Mode
  - b. Binary Inputs - shall be configured to monitor either of the following:
    - Dry Contact Maintained Mode
    - Pulse Counter Mode
  - c. Analog Outputs - shall be configured to output either of the following
    - Analog Output, Voltage Mode, 0 – 10 VDC
    - Analog Output, current Mode, 4 – 20 mA
  - d. Binary Outputs - shall output the following:
    - 24 VAC Triac
  - e. Configurable Outputs - shall be capable of the following:
    - Analog Output, Voltage Mode, 0 – 10 VDC
    - Binary Output Mode, 24 VAC Triac

9. The FEC shall have the ability to reside on a Field Controller Bus (FC Bus).
  - a. The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
  - b. The FC Bus shall support communications between the FECs and the NAE.
  - c. The FC Bus shall also support Input/Output Module (IOM) communications with the FEC and with the NAE.
  - d. The FC Bus shall support a minimum of 100 IOMs and FECs in any combination.
  - e. The FC Bus shall operate at a maximum distance of 15,000 Ft. between the FEC and the furthest connected device.
10. FEC shall be available in a 10 point version (2 UI, 1 BI, 3 BO, 4 CO) and a 17 point version (6 UI, 2 BI, 3 BO, 2 AO, 4 CO). FEC shall be able to expand I/O point capacity via the addition of Input/Output Modules and Network Sensors.
11. The FEC shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).
  - a. The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
  - b. The SA Bus shall support a minimum of 10 devices per trunk.
  - c. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the FEC and the furthest connected device.
12. The FEC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.
13. The FEC shall support, but not be limited to, the following:
  - a. Hot water, chilled water/central plant applications
  - b. Air handling units for special applications
  - c. Terminal unit applications
  - d. Special programs as required for systems control
14. The Controls Contractor shall provide FECs with unused Input/Output Module (IOM) capacity such that IOMs can be added to any existing FEC to achieve additional point capacity of 15% for each type of point (AI, BI, AO, BO, PI) currently part of the FEC input/output configuration. NO EXCEPTIONS. Additional IOM capacity shall be detailed for each FEC as part of the submittals.
15. Where indicated, or dictated by application requirements, Controls Contractor shall provide Network Control Engine(s) in lieu of FEC(s). Network Control Engines (NCE) shall combine the functionality of an NAE and a FEC. Spare capacity requirements, as detailed above, for FECs shall also apply to NCE.
  - a. NCE shall be available in a 33 point version (10 UI, 8 BI, 7 BO, 4 CO, 4 AO). NCE shall be able to expand I/O point capacity via the addition of Input/Output Modules and Network Sensors.
  - b. NCE controller and sensor/actuator communication bus shall be loaded such that only 75% of the available NCE resources are utilized during normal operation. This shall include full implementation of all trending and alarming as required by the contract documents. The Controls Contractor shall demonstrate compliance with this loading limitation to the Commissioning Agent for all NCEs provided.

B. Input/Output Module

1. The Input/Output Module (IOM) provides additional inputs and outputs for use in the associated FEC/NCE.
2. The IOM shall communicate with the FEC over the SA Bus using BACnet Standard protocol SSPC-135, Clause 9.
3. The IOM shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
4. The IOM shall be available in 4 point (4 BI), 6 point (2 UI, 2UO, 2 RO), 12 point (4 UI, 4 UO, 4 RO) and 17 point (6 UI, 2 BI, 2 AO, 3 BO, 4 CO) versions.
5. The IOM shall support the following types of inputs and outputs:
  - a. Universal Inputs - shall be configured to monitor any of the following:
    - 1) Analog Input, Voltage Mode, 0-10 VDC
    - 2) Analog Input, Current Mode, 4-20 mA
    - 3) Analog Input, Resistive Mode
    - 4) Binary Input, Dry Contact Maintained Mode
  - b. Binary Inputs - shall be configured to monitor either of the following:
    - 1) Dry Contact Maintained Mode
    - 2) Pulse Counter Mode
  - c. Analog Outputs - shall be configured to output either of the following:
    - 1) Analog Output, Voltage Mode, 0-10 VDC
    - 2) Analog Output, current Mode, 4-20 mA
  - d. Binary Outputs - shall output the following:
    - 1) 24 VAC Triac
  - e. Universal Output - shall be configured to output any of the following:
    - 1) Analog Output, Voltage Mode, 0-10 VDC
    - 2) Analog Output, Current Mode, 4-20 mA
    - 3) Binary Output Mode, 24 V AC/DC FET
  - f. Relay Output – 120/240 VAC
  - g. Configurable Outputs - shall be capable of the following:
    - 1) Analog Output, Voltage Mode, 0-10 VDC
    - 2) Binary Output Mode, 24 VAC Triac
6. The IOM shall include troubleshooting LED indicators to identify the following conditions:
  - a. Power On
  - b. Power Off
  - c. Download or Startup in progress, not ready for normal operation

- d. No Faults
- e. Device Fault
- f. Normal Data Transmission
- g. No Data Transmission
- h. No Communication

C. Variable Air Volume Controller

1. The Variable Air Volume Modular Assembly (VMA) controller shall be a programmable, digital controller that communicates via BACnet MS/TP protocol.
2. VMA shall include an integrated pressure sensor (0 to 1.5 in WC) and actuator (35 lb-in) in a pre-wired unit.
3. VMA shall connect to Network Sensors for zone and discharge air temperature sensing.
4. Actuator shall have 60 second drive time from full open to full closed position.
5. VMA point capacity shall be capable of being expanded by adding IOMs to the Sensor Actuator bus.
6. VMA shall support up to 4 zone temperature sensors and 5 discharge air temperature sensors (on the SA bus).
7. VMA shall be available in two versions:
  - a. Cooling only version
  - b. Cooling with reheat version (3 BO and 2 CO added)

D. Networked Thermostat Controller

1. Networked Thermostat Controller shall be a networked device that communicates via BACnet MS/TP protocol.
2. Networked Thermostat Controller shall be available with occupancy sensing capability built into the device.
3. Networked Thermostat Controller BACnet MS/TP communication capability shall enable remote monitoring and programming from the operator workstation.
4. Networked Thermostat Controller shall employ a unique, Proportional-Integral (PI) time-proportioning algorithm that virtually eliminates temperature offset associated with traditional, differential-based thermostats.
5. Networked Thermostat Controller shall be available in multiple versions to better match application requirements. Additional features include, but are not limited to, the following:
  - a. Occupancy override
  - b. Fan on/off and speed control
  - c. Discharge air sensor
  - d. Configurable binary inputs

E. Network Sensors

1. The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:
  - a. Zone Temperature
  - b. Zone humidity
  - c. Zone setpoint

2. The NS shall transmit the zone information back to the controller on the Sensor-Actuator Bus (SA Bus) using BACnet Standard protocol SSPC-135, Clause 9.
3. The Network Sensors shall include the following items:
  - a. A backlit Liquid Crystal Display (LCD) to indicate the Temperature, Humidity and Setpoint.
  - b. An LED to indicate the status of the Override feature.
  - c. A button to toggle the temperature display between Fahrenheit and Celsius.
  - d. A button to initiate a timed override command
4. The NS shall be available with either screw terminals or phone jack.
5. The NS shall be available in either surface mount or wall mount styles.

## 2.8 OPERATOR TOOLS

- A. A Graphical Programmer's utility tool shall be provided. The GP is a tool that provides an intuitive interface for programming, compiling and downloading control applications to BACnet controllers. An application shall represent all of the control logic in a controller. All BACnet controllers shall be programmed using the GP. The utility shall be capable of downloading application programs to all of the devices within the BMS.
- B. Portable Operator's Terminal
  1. Provide a Portable Operator's Terminal (POT) color display personal computer, software, and interfaces to provide; uploading/downloading of Controller databases, monitoring and overrides of all controller physical input/output points and editing of controller resident time schedules. POT connectivity shall be via controller communication port or digital wall sensor connected to controller.
  2. Connection of a POT to the Controller shall not interfere with normal network operation in any way, prevent alarms from being transmitted or centrally initiated commands from being executed.
  3. Functionality of the POT connected to any controller shall include:
    - Uploads and downloads Controller databases.
    - Editing of minor equipment operational parameters (including minimum on/off and delay times, changeover values, minimum position setpoints, etc.). All such mechanical equipment editable values shall contain internal Controller safety range limits to prevent accidental entry of out of range or invalid values.
    - Monitoring and overrides of all controller physical input/output points including timed overrides that automatically revert back to their normal value.
    - Display of digital sensor values including diagnostics and calibration.
    - Editing of controller time/date.
    - Editing and overrides of resident Controller time schedules.

## 2.9 INPUT DEVICES

- A. General Requirements



1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.
2. Hardware safeties (freezestat., firestat, high/low static, smoke detector, etc.) shall be automatic reset type. DDC controller software shall include provisions to automatically restart equipment after alarm condition clears. In addition, controller software shall lock-out auto restart capability after a safety trips 3 (adj.) times in a 12 hour period. Auto restart capability lock-out shall be alarmed at the central operator workstation as well as text messaged to designated owner personnel.
3. Hardware safeties (freezestat., firestat, high/low static, smoke detector, etc.) shall be hardwired to their associated starter, VFD, etc. The hardware terminal device shall include an auxiliary set of contacts for input of alarm condition to the DDC system. Hardware safety alarm trips shall be alarmed at the central operator workstation as well as text messaged to designated owner personnel.

B. Temperature Sensors

1. General Requirements:
  - a. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations. (BMS Contractor shall utilize transmitters where distances involved exceed maximum recommended wire run lengths.)
  - b. The temperature sensor shall be of the resistance type and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
  - c. Thermistor type sensors shall be acceptable for room terminal equipment space temperature sensors provided they meet the accuracy specifications below.
  - d. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion.

Point Type	Accuracy
Room Temp	+/- 0.5°F
Duct Temperature	+/- 0.5°F
Water Temperature *	+/- 0.5°F
All Others	+/- 0.75°F

\* excludes central plant chilled water and hot water systems

2. Room Temperature Sensors
  - a. Room sensors shall be constructed for either surface or wall box mounting.
  - b. Room sensors shall have the following options when specified:
    - Setpoint reset slide switch providing a +/- 3 degree (adjustable) range.
    - Individual heating/cooling setpoint slide switches.

- A momentary override request push button for activation of after-hours operation.
  - Analog thermometer.
3. Room Temperature Sensors with Integral Display
- a. Room sensors shall be constructed for either surface or wall box mounting.
  - b. Room sensors shall have an integral LCD display and four button keypad with the following capabilities:
    - Display room and outside air temperatures.
    - Display and adjust room comfort setpoint.
    - Display and adjust fan operation status.
    - Timed override request push button with LED status for activation of after-hours operation.
    - Display controller mode.
    - Password selectable adjustment of setpoint and override modes.
4. Outside Air Sensors
- a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
  - b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
  - c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
  - d. When the building is oriented such that there is no direct north facing exposure, a protective enclosure shall be provided for the outside air sensor. This enclosure shall be mounted such that it is extended away from the building structure to prevent any solar radiation, from the structure, affecting the sensor reading, shall be enclosed to prevent rain from contacting the sensor and shall be ventilated to allow ambient air to flow over the sensor without internal temperature build up due to solar gain. Enclosure shall be constructed of aluminum or stainless steel so it does not corrode.
5. Refrigerator or Freezer Internal Temperature Sensors
- a. Temperature sensors used to measure refrigerator or freezer internal temperatures shall be equipped with a thermal buffer feature. Buffer shall be a fluid filled chamber. Chamber fluid shall be food grade glycol antifreeze. Buffer chamber shall be machined 304 Stainless Steel or aluminum.
  - b. Temperature operating range of sensor shall be -40 to 185°F. Temperature operating range of transmitter shall be -4 to 158°F. Operating Humidity range shall be 0-100%RH, condensing.
  - c. Basis of Design: BAPI Thermobuffer Temperature Sensor.
6. Duct Mount Sensors (Rigid Type)
- a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.

- b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
  - c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.
- 7. Averaging Sensors (Bendable)
  - a. For ductwork greater in any dimension than 48 inches and/or where air temperature stratification exists, a bendable averaging sensor with a continuous single element to sense true average temperature along their entire length shall be used.
  - b. Capillary supports at the sides of the duct shall be provided to support the sensing string.
- 8. Humidity Sensors
  - a. The sensor shall be a solid-state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.
  - b. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
  - c. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 2% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.
  - d. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with seal-tite fittings and stainless steel bushings.
  - e. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
  - f. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
  - g. Acceptable Manufacturers: Johnson Controls, Veris Industries, and Mamac.
- C. Differential Pressure Transmitters – (Non-Central Plant Systems)
  - 1. General Air and Water Pressure Transmitter Requirements:
    - a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
    - b. Pressure transmitters shall transmit a 4 to 20 mA output signal.
    - c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.
    - d. A minimum of a NEMA 1 housing shall be provided for the transmitter.
    - e. Air type: Transmitter shall be provided in a NEMA enclosure with barbed fittings for connection of signal lines.
    - f. Wet type: Shall be enclosed in a NEMA enclosure with a 5 valve bypass assembly.
  - 2. Low Differential Water Pressure Applications (0" - 20" w.c.)

- a. The differential pressure transmitter shall transmit a linear, 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points.
  - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
    - .01 - 20" w.c. input differential pressure range.
    - 4 - 20 mA output.
    - Maintain accuracy up to 20 to 1 ratio turndown.
    - Reference Accuracy: +/- 0.2% of full span.
  - c. Acceptable Manufacturers: Setra and Mamac.
3. Medium to High Differential Water Pressure Applications (Over 21" w.c.)
  - a. The differential pressure transmitter shall meet the low pressure transmitter specifications with the following exceptions:
    - Differential pressure range 10" w.c. to 300 PSI.
    - Reference Accuracy: +/- 1% of full span (includes non-linearity, hysteresis, and repeatability).
  - b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
  - c. Acceptable Manufacturers: Setra and Mamac.
4. Building Differential Air Pressure Applications (-0.05" to +0.05" w.c. up to -1.0" to +1.0" w.c.)
  - a. The differential pressure transmitter shall transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
  - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
    - -0.05" to +0.05" w.c. up to -1.0" to +1.0" w.c. input differential pressure ranges. Provide range appropriate for system application.
    - 4 - 20 mA output.
    - Maintain accuracy up to 20 to 1 ratio turndown.
    - Reference Accuracy: +/- 0.25% of full span.
  - c. Acceptable Manufacturers: Setra Model 264.
5. Low Differential Air Pressure Applications (0" to 1.0" w.c. up to 5.0" w.c.)
  - a. The differential pressure transmitter shall transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.

- b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
    - (0.0" - 1.0" up to 5.0" w.c.) input differential pressure ranges. Provide range appropriate for system application.
    - 4 - 20 mA output.
    - Maintain accuracy up to 20 to 1 ratio turndown.
    - Reference Accuracy: +/- 0.25% of full span.
  - c. Acceptable Manufacturers: Johnson Controls and Setra.
6. Medium Differential Air Pressure Applications (5" to 21" w.c.)
- a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except that the performance specifications are not as severe. Differential pressure transmitters shall be provided that meet the following performance requirements:
    - Zero & span: (c/o F.S./Deg. F): .04% including linearity, hysteresis and repeatability.
    - Accuracy: +/- 1% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 PSIG).
    - Thermal Effects: <+.033 F.S./Deg. F. over 40°F. to 100°F. (calibrated at 70°F.).
  - b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
  - c. Acceptable manufacturers: Johnson Controls and Setra.

D. Differential Pressure Switches

- 1. Air type: Shall be diaphragm actuated type with a single-pole, double-throw, snap-acting switch. Motion of the diaphragm shall be restrained by a calibrated spring that can be adjusted to set the exact pressure differential at which the electrical switch will be actuated. Motion of the diaphragm shall be transmitted to the switch button by means of a direct mechanical linkage. Electrical rating shall be 6.0 amps at 120 VAC. Pressure range and temperature limits shall be suitable for the application. Switch shall be utilized in conjunction with static pressure probes when utilized across filters, and a static pressure probe on the low side and a velocity probe on the high side when utilized across a fan
- 2. Water type: Shall be diaphragm-actuated type with a single-pole, double-throw snap-acting switch. Motion of the diaphragm shall be restrained by a calibrated spring that can be adjusted to set the exact pressure differential at which the electrical switch will be actuated. Switch shall be utilized in conjunction with shut off valves on the low and high sides of the switch to allow for ease of service.

- E. Duct Shielded Static Pressure Probe: Probes shall extend the full width of the duct and contain multiple static pressure sensors located along the exterior surface of the cylindrical probe. Said sensors shall not protrude beyond the surface of the probe. The Duct Static Pressure Traverse Probe(s) shall be of extruded aluminum construction and (except for 3/4" dia. probes with lengths of 24" or less) be complete with threaded end support rod, sealing washer and nut, and mounting plate with a gasket and static pressure signal fitting. The Duct Static Traverse Probe(s) shall be capable of producing a steady, non-pulsating signal of standard static pressure, without need for correction factors, with an instrument accuracy of 1%. Duct Static Pressure Traverse Probe(s) (STAT-probe) shall be as manufactured by Air Monitor Corporation or approved equal.
- F. Space Static Pressure Sensing Probes: Probes shall be constructed of brushed aluminum with clear anodized finish and suitable for wall or ceiling mounting. Probes shall sense static pressure within 1% of actual pressure value while subjected to a maximum air flow of up to 1000 FPM from a 360° radial source. Space Static Pressure Sensing Probes shall be model S.A.P. as manufactured by Air Monitor Corporation or approved equal.
- G. Shielded Static Outside Air Probe: Probe shall be constructed of 10 ga. Type 316 stainless steel with a 2" diameter FPT connection. The outdoor air probe shall be capable of sensing the outside atmospheric air pressure to within 2% of the actual value when subjected to radial wind velocities up to 40 miles per hour with approach angles up to 30° to the horizontal. The Shielded Static Outside Air Probe shall be the S.O.A.P. as manufactured by Air Monitor Corporation or approved equal.
- H. Carbon Dioxide (CO2) Room/Duct Sensor
1. Sensor shall be wall mounted BAPI-STAT 4 / duct mounted BAPI-Box enclosure type.
  2. Sensor to be used for sensing carbon dioxide (CO2) level in accordance with the non-dispersive infrared method.
  3. Optimized for periodically unoccupied areas.
  4. Automatic background calibration over a long time period to reduce drift with continuous automatic barometric pressure compensation and ambient temperature compensation.
  5. No Maintenance or recalibration required.
  6. CO2 measuring range: 0 to 2000 ppm; accuracy: +/- 30 ppm CO2 or 3% of reading, whichever is greater, between 400 to 1,250 ppm.
  7. Selectable Output of: 0 to 5 VDC or 0 to 10 VDC.
  8. 12 to 30 VAC or 12 to 24 VDC power.
  9. BAPI-Stat 4 enclosure with blank cover / BAPI-Box duct enclosure.
- I. Hot and Chilled Water Flow Meter
1. Submittals
    - a. Submit product data sheets for water flow indicating minimum placement requirements related to length of straight pipe upstream and downstream of the flow meter and installed accuracy to the host control system.
  2. Qualifications and Quality Assurance
    - a. Manufacturer Qualifications: The successful firm shall have a minimum of ten years of experience producing pulse output water flow meters

- b. Installer Qualifications: An experienced installer who is an approved installer of the instrument manufacturer for both installation and maintenance of units required for this Project.
    - c. Any and all power requirements for flow meters shall be the responsibility of the successful BMS contractor.
  3. System Responsibility
    - a. The contractor shall be responsible for any and all costs associated with any and all changes resulting from the use of a supplier other than the listed acceptable manufacturer.
  4. Water Flow Meter
    - a. Subject to compliance with performance and design requirements of this Section, provide products that comply with this specification by the following vendor:
      - ONICON F-1210 Dual Turbine Insertion Flow Meter (basis of design)
    - b. Flow meter to meet the following specifications.
      - Provides non-isolated 4-20 mA and 0-10 V analog output signals that are linear with the flow rate.
      - Flow accuracy shall be +/-0.5% of reading at calibrated velocity.
      - Standard Design water temperature for the meter is 180° F continuous, 200° F peak.
      - High Temperature Design water temperature for the meter is 280° F continuous, 300° F peak.
      - Design maximum operating water pressure for the meter is 400 psi.
      - Pressure drop less than 1.0 psi at 20 fps in 2.5" pipe.
      - Certificate of calibration traceable to N.I.S.T.
      - Two-year warranty
      - Simplified Hot Tap Insertion Design to allow removal by hand without system shutdown.
- J. Make-up Water Flow Meter
  1. Submittals
    - a. Submit product data sheets for water flow indicating minimum placement requirements related to length of straight pipe upstream and downstream of the flow meter and installed accuracy to the host control system.
    - b. All flow meters shall be specified as an "In-Line" style to simplify installation. Insertion style meters are not acceptable.
  2. Qualifications and Quality Assurance
    - a. Manufacturer Qualifications: The successful firm shall have a minimum of ten years of experience producing pulse output water flow meters

- b. Installer Qualifications: An experienced installer who is an approved installer of the instrument manufacturer for both installation and maintenance of units required for this Project.
  - c. Any and all power requirements for flow meters shall be the responsibility of the successful BMS contractor.
- 3. System Responsibility
  - a. The contractor shall be responsible for any and all costs associated with any and all changes resulting from the use of a supplier other than the listed acceptable manufacturer.
- 4. Water Flow Meter
  - a. Subject to compliance with performance and design requirements of this Section, provide products that comply with this specification by the following vendor:
    - Seametrics, MJR Series Pulse Meter (basis of design)
  - b. Flow meter to meet the following specifications.
    - A pulse output using a reed switch sensor with maximum current of 20mA and maximum voltage of 24Vdc.
    - Flow accuracy shall be +/-1.5% of reading over the entire operating flow range.
    - Design maximum water temperature for the meter is 105° F.
    - Design maximum operating water pressure for the meter is 150 psi.

K. Smoke Detectors

Ionization type air duct detectors shall be furnished as specified elsewhere in Division 26 for installation under Division 23. All wiring from air duct detectors to fire alarm system shall be provided under Division 26, Fire Alarm System. All other wiring not directly to the fire alarm system shall be furnished and installed by this BMS Contractor.

L. Air Flow Stations Provided with HVAC Equipment

Where air flow stations are provided by the HVAC equipment manufacturer this BMS Contractor shall furnish and install all required transducers, pneumatic tubing, wiring and power supplies required to convert the signal provided by the air flow station into a 4 to 20 ma process signal that can be precisely utilized by the BMS system. The equipment manufacturer shall provide pressure to air flow curves for each air flow station to the BMS Contractor for selection of transducer range and air flow scaling.

M. Lighting Control System Interface

The Electrical contractor shall furnish and install a digital Lighting Control System with a BACnet IP interface. This BMS Contractor shall use this BACnet IP interface for integration with the Lighting Control System as detailed elsewhere herein.

N. Room Humidistat



1. Room wall mount humidistat with SPDT contacts rated at FLA of 7.2 amps and LRA of 43.2 amps at 120 VAC.
2. Scale range shall be 10% to 90% RH.
3. Differential of 5% RH.
4. Cover blank with concealed setpoint adjustment.

O. Carbon Monoxide Sensor/Transmitter

1. Fully electronic utilizing field replaceable electromechanical sensor technology with 4 year typical sensor lifespan. Unit shall include span and zero adjustment capability. Sensor shall be capable of field calibration and shall indicate the need for sensor replacement when the sensor reaches the end of its useful life. Provide sufficient gas calibration adapters, gas calibration kits, and remote auxiliary displays to allow for routine calibration of all of the sensors installed on this project at the manufacturer recommended intervals throughout the commissioning process and warranty period.
2. Unit shall be model GSTA-C as manufactured by Dwyer Instruments or greater than or equal to equivalent by Acme Engineering with the following specification requirements:
  - a. Range: 0 to 200 ppm
  - b. Output: 4 to 20 mA (loop powered)
  - c. Operating temperature range: -4°F to +122°F
  - d. Operating humidity range: 15% to 90% RH constant, 0% to 99% RH intermittent
  - e. Resolution: 1 ppm
  - f. Accuracy: 2%
  - g. Response time: < 45 seconds to 90% CO
  - h. Long term drift: < 5% per year in air
  - i. Minimum coverage area: 5000 Ft<sup>2</sup>
  - j. Mounting height: 5 to 6 feet above the floor
  - k. Housing: UV resistant glass filled polycarbonate – NEMA 1
  - l. Power supply: 10 to 35 VDC
  - m. Manufacturer's warranty: 1 year

P. Nitrogen Dioxide Sensor/Transmitter

1. Fully electronic utilizing field replaceable electromechanical sensor technology with 4 year typical sensor lifespan. Unit shall include span and zero adjustment capability. Sensor shall be capable of field calibration and shall indicate the need for sensor replacement when the sensor reaches the end of its useful life. Provide sufficient gas calibration adapters, gas calibration kits, and remote auxiliary displays to allow for routine calibration of all of the sensors installed on this project at the manufacturer recommended intervals throughout the commissioning process and warranty period.
2. Unit shall be model GSTA-N as manufactured by Dwyer Instruments or greater than or equal to equivalent by Acme Engineering with the following specification requirements:
  - a. Range: 0 to 10 ppm
  - b. Output: 4 to 20 mA (loop powered)
  - c. Operating temperature range: -4°F to +122°F
  - d. Operating humidity range: 15% to 90% RH constant, 0% to 99% RH intermittent
  - e. Resolution: 0.1 ppm
  - f. Accuracy: 3%
  - g. Response time: < 25 seconds to 90% NO<sub>2</sub>

- h. Long term drift: < 5% per year in air
- i. Minimum coverage area: 5000 Ft<sup>2</sup>
- j. Mounting height: 5 to 6 feet above the floor
- k. Housing: UV resistant glass filled polycarbonate – NEMA 1
- l. Power supply: 10 to 35 VDC
- m. Manufacturer's warranty: 1 year

Q. Occupancy Sensor

- 1. Unit shall be model CX-100 as manufactured by Wattstopper equal to equivalent.
- 2. Power 24VDC
- 3. Shall have isolated relay
- 4. Adjustable sensitivity

R. Heat Trace Voltage Monitor

- 1. Continuous duty, Single setpoint voltage sensor
  - a. Input voltages above the setpoint cause the output contacts to energize and trip the circuit. Input voltages below the setpoint cause the output contacts to de-energize and enable the circuit. The dead band between pull-in and drop-out is less than 2%.
  - b. Adjustable setpoint range of 35% of the maximum voltage. Unit to be provided with factory calibrated trip point. Expected life mechanically to 10 million operations. Expected life electrically to 100,000 operations at rated load.
  - c. Additional performance specifications:
    - Automatic reset
    - AC models not frequency sensitive
    - DC models not polarity sensitive
    - Transient protection 2500 VRMS for 10ms
    - Supply current 10mA maximum
    - Setpoint stability: +/- 1%
    - Response time: 100ms
    - Operating temperature: -20°F to +131°F
    - Humidity tolerance: 0 to 97% without condensation
  - d. Basis of design: Time Mark Corporation, Model 260
  - e. Specific Models: #AC260B-90-150 for 120 VAC or AC260B-215-290 for 277 VAC

2.10 OUTPUT DEVICES

A. Actuators

- 1. General Requirements
  - a. Damper and valve actuators shall be electronic.
- 2. Electronic Damper Actuators

- a. Electronic damper actuators shall be direct shaft mount.
- b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.
- c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication.
- d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.
- e. All actuators used on outdoor air intake or relief dampers or actuators used on terminal equipment (air handling units and other equipment with outdoor air intakes, etc.) control valves shall be of the spring return to fail-safe position type. Non-spring return actuators shall not be acceptable. Batteries used to provide fail safe operation shall not be acceptable.
- f. Acceptable manufacturers: Honeywell, Johnson Controls, Schneider Electric or Siemens.

**B. Control Dampers**

1. The BMS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BMS Contractor or as specifically indicated on the Drawings.
2. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.
3. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
4. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.0 cfm per square foot when closed against 4" w.g. static pressure when tested in accordance with AMCA Std. 500.

5. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g. Acceptable manufacturers are Johnson Controls D-7250 D-1250 or D-1300, Ruskin CD50, Vent Products 5650, or equivalent as manufactured by Honeywell or Siemens.
  6. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below. Acceptable manufacturers are: Johnson Controls D-1600, Ruskin CD36, Vent Products 5800, or equivalent as manufactured by Honeywell or Siemens.
  7. Multiple section dampers may be jack-shafted to allow mounting of piston pneumatic actuators and direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.
- C. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated. All valves shall be fully modulating unless otherwise indicated. BMS Contractor shall be responsible for selection of proper control valves for project, in accordance with the parameters defined by the following paragraphs, including sizing, pressure rating, flow coefficient, flow characteristic, close-off rating and allowable leakage factor. Valve construction shall be as follows with NO EXCEPTIONS. Globe valves shall be used for all AHU applications, ball valves shall be used for all VAV/CV hot water coils/radiant panels, and terminal unit control valves shall be used for CUH. Globe valves shall be used for the hot water and chilled water systems.
1. Globe Valves NPS 2" and Smaller: Bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure. Valves shall have allowable media temperature of 20°F to 281°F to assure that the valve packing will have a long life (valves with narrower allowable media temperatures have no reserve packing capability for long term watertight seal).
  2. Globe Valves NPS 2-1/2" and Larger: Iron body, bronze trim, rising stainless steel stem, plug-type disc, flanged ends, and renewable seat and disc.
  3. Hydronic system globe valves shall have the following characteristics:
    - a. Rating: Class 125 for service at 125 psig. and 250°F operating conditions.
    - b. Internal Construction: Replaceable plugs and seats of stainless steel or brass.
      - 1) Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.
      - 2) Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.
    - c. Sizing: 3 psig. maximum pressure drop at design flow rate.
    - d. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics. Operators shall close valves against pump shutoff head.
  4. Control Ball Valves 3 inches and smaller (2 inches for 3-way valves): Forged brass body (CuZn39Pb2), chrome plated brass ball and blowout proof stem and EPDM O-rings with minimum 600 psi rating. Valve shall contain glass filled ball insert capable of providing equal percentage flow. Valves shall have allowable media temperature of 20 Deg F to 250 Deg F.

- a. Rating: Minimum 100 psi close off on 2 way valves and 70 psi on 3 way valves.
  - b. Medium: Valves shall be used with hot water or cold water with up to 50% glycol.
  - c. Sizing:
    - 1) Minimum 100 psi close off on 2 way valves and 70 psi on three way valves
    - 2) Maximum differential shall be 35 psi to ensure quiet operation.
  - d. Flow Characteristics: 2 way vales shall have equal percentage characteristics. 3 way valves shall have an equal percentage characteristic through the control port and a linear characteristic through the bypass port.
5. Butterfly Valves: 200 psig. maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals. Butterfly valves shall only be used for control valves sized larger than 6 inches.
- a. Body Style: Wafer, Lug, or Groove
  - b. Disc Type: Nickel-plated ductile iron, Aluminum bronze, Elastomer-coated ductile iron, Epoxy-coated ductile iron.
  - c. Sizing: 1 psig. maximum pressure drop at design flow rate.
6. Terminal Unit Control Valves: 360 psi forged yellow brass body, nickel plated brass ball, with optimizer insert for modulating applications, blow-out resistant stem, two or three-port as indicated, and threaded ends for chilled or hot water, up to 50% glycol solutions. Actuators shall be as noted above with 5 year warranty. Spring return is required for all Unit Ventilator heating valves and other terminal equipment that has an outside air source. All non-spring return valves must have manual override ability built in to the actuator.
- a. Rating: ANSI class IV, maximum static pressure of 250 psig., minimum fluid temperature of 20°F and maximum of 250°F operating conditions.
  - b. Sizing: 4 psig. maximum pressure drop at design flow rate, to close against pump shutoff head.
  - c. Flow Characteristics: Two-way and three-valves shall have equal percentage characteristics.
7. Actuation: Valve actuators shall be selected to provide proper control, and close-off as required by the application. All valves actuators shall be provided with position indication. Actuators shall be provided with weatherproof option where dictated by the device location.

D. Control Relays

1. Control Pilot Relays

- a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
- b. Mounting Bases shall be snap-mount.
- c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
- d. Contacts shall be rated for 10 amps at 120VAC.
- e. Relays shall have an integral indicator light and check button.

f. Acceptable manufacturers: Johnson Controls, Potter and Brumfield

E. Signal Isolators

1. Isolated DC to DC Transmitters shall:
  - a. Eliminate ground loop wiring problems.
  - b. Provide jumper selectable current or voltage inputs.
  - c. Provide jumper selectable current or voltage outputs.
  - d. Provide linearity of better than 0.5% of span.
  - e. Provide isolation of 1000V (DC or AC peak) maximum
  - f. Provide an operating temperature range of 14 deg. F. to 140 deg. F.
  - g. Provide an operating humidity range of 5% to 95% RH non-condensing

2.11 EMERGENCY AND STANDBY POWER

- A. BMS workstations and selected controllers shall be placed on normal/emergency power. The following equipment shall be on normal/emergency power:
  - BMS Network Control Panels (NAEs) and BMS Computer Workstation/Server
- B. BMS computer workstation/servers and network controllers shall also be provided with a UPS to maintain workstation/controller operation through a power loss until the generator is on line
  1. The system shall be provided with sufficient UPS standby power to operate the workstation/controller upon loss of normal AC power in a normal mode for a period of 5 minutes. The incoming normal power to the workstation/controller shall be monitored so that any power failure will be indicated at the workstation/controller. The system shall automatically transfer to battery standby upon AC power failure. All battery charging and recharging operations shall be automatic. The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be alarmed.
  2. UPS power supplies shall condition and maintain clean power to each indicated device. This shall include surge protection and filtering.
  3. UPS power supplies shall also include LED status display for:
    - On line power.
    - On battery power.
    - Replace Battery
    - Audible alarm when on battery
    - Distinctive low battery alarm.

2.12 VARIABLE FREQUENCY DRIVES

- A. Variable frequency drives shall be provided by the HVAC Contractor. The BMS Contractor shall control and communicate with the VFDs as further defined below.
- B. Serial Communication:

1. The VFD shall have a BACnet port as standard. Each individual drive shall have the selected protocol factory installed in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be “certified” by the governing authority. Use of non-certified protocols is not allowed.
2. It will be the responsibility of each drive manufacturer to insure, that the correct Serial Communication for this Project has been selected and installed in each drive at the manufacturers factory.
3. The BACnet connection shall be an RS485, MSTP interface. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed.
4. If additional hardware is required to obtain the BACnet interface, the VFD manufacturer shall supply one BACnet gateway per drive. Multiple VFDs sharing one gateway shall not be acceptable.
5. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, PID control adjustments. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus – keypad “Hand” or “Auto” selected, the ability to change the PID setpoint, and the ability to force the unit to bypass (if bypass is specified). The DDC system shall also be able to monitor if the motor is running in the VFD mode or bypass mode (if bypass is specified) over serial communications. A minimum of 15 field parameters shall be capable of being monitored.

C. VFD Control

1. The VFD shall allow the DDC to control the drive’s digital and analog outputs via the serial interface. This control shall be independent of any VFD function. However, for this project, the drives shall be monitored through the Serial Communication but additionally incorporate a hard wired analog input for speed control of the drives and a binary input for the Starting and Stopping of the drives.

2.13 MISCELLANEOUS DEVICES

A. Local Control Panels

1. The BMS Contractor shall provide wired and piped panels for each applicable HVAC system, excluding terminal equipment. Panels shall be constructed of furniture grade steel painted to match DDC controller enclosures and shall be located adjacent to the DDC controllers involved. All thermal switches, transformers, power supplies, transducers, signal isolators, etc. shall be mounted, wired and piped in each panel along with all necessary identification tags. Gauges with identification tags shall be provided for each incoming and outgoing pneumatic line. All control panels shall be UL listed. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and slotted flush latch.

2. Controllers mounted outdoors, such as on or in roof top equipment, shall be mounted within appropriate NEMA rated and size enclosures. Enclosures shall dissipate heat generated from contents plus any/all solar loading that occurs due to the enclosures installed location to prevent damage to any items contained within enclosure. In turn, enclosure heat shall be thermostatically controlled to prevent damage to any contained devices from condensation or low temperatures. All wire ways and/or conduits entering control enclosures shall be sealed where the wiring enters control enclosure to prevent the migration of air and/or moisture into or out of the enclosure. The mounting location of enclosures shall be coordinated with all applicable trades and the professionals and shall only be mounted where the installed location does not interfere with or cause problems with the unit construction, installation, operation, roof snow build up, future serviceability or future warranty.
3. All panel wiring shall be to and from terminal strips. The use of wire nuts for connection of wiring to or from a common point is not acceptable.
4. All I/O connections on the DDC controller shall be provided via removable or fixed screw terminals.
5. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
6. All wiring shall be neatly installed in plastic trays.
7. All wiring shall be identified.
8. A convenience 120 VAC duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.

**B. Power Supplies**

1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
2. Input: 120 VAC +10%, 60Hz.
3. Output: 24 VDC.
4. Line Regulation: +0.05% for 10% line change.
5. Load Regulation: +0.05% for 50% load change.
6. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
8. A power disconnect switch shall be provided next to the power supply.

**C. 120 VAC to 24 VAC Power Boxes**

1. Furnish and install UL listed, Class 2, UL916 power boxes. Power Boxes shall accept 120 VAC input and provide 24 VAC output. Furnish and install power boxes as required to satisfy connected load requirements. Power boxes shall be NEMA 1 rated enclosure and contain one or multiple outputs. Each 24 VAC output shall contain a combination on/off switch and circuit breaker. Each output shall be an isolated 24VAC 75 or 100 VA output with a red LED for output voltage indication.

**D. Thermostats**



1. Electric room thermostats of the heavy-duty type shall be provided for unit heaters, cabinet unit heaters, and ventilation fans, where required. All these items shall be provided with concealed adjustment. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer's standard finish.

E. Thermostat, Humidistat and CO<sub>2</sub> Sensor Guards

1. All thermostats, humidistats and CO<sub>2</sub> sensors located in public and non-supervised areas shall be fitted with tamperproof Lexan guards. Provide clear plastic lockable covers for thermostats located in classrooms, libraries, auditoriums, gymnasiums, cafeterias, conference corridors, entrance vestibules and all other public spaces.

F. Break Glass Stations

1. Boiler Room break glass stations shall be provided by the boiler equipment supplier as part of the Boiler Emergency Shutdown System and monitored by the DDC system. All required Interlock and control wiring shall be by the boiler control panel supplier. An alarm shall be generated at the BMS whenever the emergency shutdown system is activated.

### PART 3 – PERFORMANCE / EXECUTION

#### 3.1 BMS SPECIFIC REQUIREMENTS

A. Graphic Displays

1. Provide a graphic system flow diagram display for each system with all points as indicated on the point list.
2. User shall access the various system schematics via a graphical penetration scheme including dash board type selection screens to select scheduling and trends.
3. All setpoints, parameters, etc. designated as manually adjustable (i.e. adj.) in the sequences of operation shall be directly adjustable from the associated graphic screen or a separate setpoint screen, the latter being directly accessible via a transfer point on the original graphic screen. It shall not be necessary to leave the graphic screen package in order to make the adjustments. NO EXCEPTIONS. Setpoint adjustment shall be a single step process (i.e. not require multiple save operations) and all setpoint changes shall be retained during power outages. Any deviation from these requirements shall be clearly pointed out in the BMS Architecture Overview submission that accompanies the bid.
4. Alarm limit, setpoint and reset schedule values indicated in the specifications or sequences of operation are given as starting points only. Final values shall be established during the commissioning process and provided in hard copy documented format by the BMS Contractor as part of the O & M manual submission at project completion.

- B. In addition to the override functions described or implied elsewhere, the BMS shall include the following global overrides at the colorgraphic level.

Hot Water Valves (includes reheat coils)

Open all hot water control valves fully  
Close all hot water control valves fully  
Automatic control of all hot water valves.

Each AHU System (applies to boxes connected to given AHU only)

Open all VAV boxes fully  
Close all VAV boxes fully  
All VAV boxes to minimum CFM  
All VAV boxes to maximum CFM  
Automatic control of all VAV boxes  
Open all CAV boxes fully  
Close all CAV boxes fully  
Automatic control of all CAV boxes  
Open all reheat coil/radiant panel valves fully  
Close all reheat coil/radiant panel valves fully  
Automatic control of all reheat coil/radiant panel valves

- C. The following graphical screens, as a minimum, shall be developed for this project. For each system or floor plan, the display shall contain the points identified in the Sequence of Operation point list (or available via the interface) as well as associated software points and allow for setpoint changes, overrides etc. Where necessary, multiple graphic screens shall be provided for a unit/system in order to convey the required information in an uncluttered fashion. In addition, on-line access to current BMS as-built record drawings and documentation shall be available from the graphic package. Sequence of operation information, shop drawings and specification data sheets associated with a system shall be available from the graphic screen associated with that system. This feature shall be fully implemented for the graphic screens created for this project. Sequence of operation information shall include full detail for procedures to be followed when operating the system in Manual and Local modes. NO EXCEPTIONS. The BMS shall also include implemented override capability of all controller outputs (for controllers provided by the BMS Contractor) via the graphics for an authorized user.

- Main Screen
- Weather Station Overview
- Building Overview with Floor/Area Selection
- Thermographic floor plan with transfer to terminal units
- Mechanical Room with transfer to HVAC equipment
- Roof Plan with transfer to HVAC equipment
- Hot Water System Overview
- Hot Water System Setpoints
- Hot Water Circulating Pumps (including VFD communication interface points)
- Boiler # 1 (including communication interface points)
- Boiler # 2 (including communication interface points)
- Boiler Room Ventilation Control
- AHUs
- AHU Setpoints
- Individual VAV Boxes (one screen per VAV box)
- Individual CAV Boxes (one screen per CAV box)
- Exhaust Fans (one screen per fan/group)

- Split Systems (one screen per S/S unit)
  - Computer Room AC Equipment
  - VRF Outdoor Units (one screen per outdoor unit)
  - VRF Indoor Units (one screen per room/indoor unit)
  - Emergency Generator
  - Generator Room Ventilation Control
  - Standalone Radiant Panels/Convectors (one screen per panel/convector)
  - Equipment “Out-of-Service” Switch Selection (one screen per subsystem)
  - Equipment Lead/Lag Selection (one screen per subsystem)
  - OSS Schedules (one screen per zone)
  - OSS Schedule Overrides (one screen per zone)
  - Holiday Schedules
  - Miscellaneous
- D. The BMS graphics will include implemented “view only” capability for selected personnel.
- E. Alarm Requirements
1. All alarm conditions (ALL MTR (\*), COS (~), LIMIT (~) and RTN (~) alarm information designated in the I/O Points List) shall be indicated by showing a red alarm icon on the current graphic display. A separate page shall be used to display alarm details. AVs and BVs read/written across 3<sup>rd</sup> party communication interfaces shall also be treated as I/O points for alarming purposes and alarmed as determined by the owner.
  2. Refer to Section 230993, Alarm Requirements for additional information about alarms to be fully implemented by the BMS Contractor as part of the work of this project.
- F. Trend Requirements
1. All I/O points and setpoints shall be linked to BACnet trend objects. The controller(s) shall record a trend sample every 15 minutes (adj.) for each trend object and save the most recent 120 (adj.) samples.
  2. AVs and BVs read/written across 3<sup>rd</sup> party communication interfaces shall also be treated as I/O points for trending purposes.
  3. Refer to Section 230993, Trend Requirements for additional information about trends to be fully implemented by the BMS Contractor as part of the work of this project.
- G. Custom Reports:
1. Provide custom reports as required for this project:
- H. Actuation / Control Type
1. Primary Equipment
    - a. All damper and valve actuation shall be electric.
  2. Terminal Equipment
    - a. All damper and valve actuation shall be electric.

- I. The Controls Contractor shall meet with the owner to determine routing requirements for all alarm information. Particular attention shall be paid to developing a routing procedure that prevents non-critical alarms from impacting critical system operation. The prioritization and routing shall be fully implemented to the satisfaction of the owner.

### 3.2 INSTALLATION PRACTICES

- A. Existing and New ATC System Installation Scope, Phasing, Implementation, Coordination and Demolition
  1. SCOPE: Several mechanical systems are not being replaced by the renovation project. It is the intent of this project that those remaining systems will also be controlled by the new BMS. Therefore, it is specifically required by this section that an entirely new Facility Wide BMS system be installed with appropriate DDC controllers on every new as well as every reused existing mechanical system as defined within sections 230900 and 230993.
  2. PHASING: Work of this section shall be coordinated with actual dynamic scheduling of phasing of all other trades. During the renovation process, the BMS Contractor shall address operation of hybrid controls, whereby part of the HVAC equipment is controlled by the existing control system while the other part(s) are controlled by the new BMS, while still maintaining interior environmental conditions that are acceptable to the owner. The intent is to maintain integrated performance of existing automatic temperature control systems and new BMS systems, to the maximum extent possible, throughout the renovation process.
  3. IMPLEMENTATION: As soon as a BMS DDC controller is placed into operation, whether temporary or permanent, it shall be connected to the Dedicated Web Based User Interface, the Distributed Web Based User Interface and the Network Automation Engine which have already been placed into complete operation with complete functionality for each installed DDC controller. This shall include the installation of the high speed internet service, connection, wiring and devices; all required Ethernet network wiring and devices and all required BMS communication network wiring and devices for each segment placed into operation whether infrastructure is installed temporarily or permanently until such time the complete system can be permanently installed.
  4. COORDINATION: The BMS subcontractor shall coordinate the existing control system demolition with the work of all the other trades. All portions of the facility that are to remain operational shall have their control systems left intact and operational until that specific phase is due for remodeling. Any controls, tubing and/or wiring that were demolished prematurely, shall be placed back into operation by this subcontractor until the area served is to be remodeled. The BMS subcontractor shall demo any/all existing control items, wiring, tubing and etc. that the other trades have not already demolished during the performance of their work. The BMS subcontractor shall perform all cutting, patching and painting as required for the removal of the existing control system. Any existing HVAC equipment to remain shall be tied into the new BMS system as required.

5. DEMOLITION: All old terminal devices will be removed, and associated wiring/tubing will be removed back to their source as part of the work of this project. All air lines that must remain active until a later time shall be capped air tight and leak free, where partial removal has been required. Empty conduit(s) that remain can be used by the new BMS as applicable. The BMS Contractor shall coordinate with the owner, prior to any demolition activities by the Mechanical Contractor or the BMS Contractor, to determine any existing automatic temperature control devices that will be carefully salvaged and turned over to the owner as spare parts.
  - a. Where demolition work associated with the existing pneumatic/electric system is indicated by the contract documents, all panels, devices, wiring, and tubing associated with the demolition will be removed under this new project. The BMS Contractor shall be responsible for patching and painting required as a result of the demolition process. Painting and patching shall match surrounding conditions.
  - b. All abandoned, and all unused pneumatic tubing shall be removed to its point of origin. At the tubing disconnect point, the remaining tubing shall be capped (plastic tubing capped with a barbed plug and copper tubing capped by soldering on a copper cap.) to provide a pressure tight and non-leaking cap.
  - c. The BMS Contractor shall complete an ATC compressor run time benchmark test prior to starting work. The test shall be witnessed by the owner's representative. The BMS Contractor shall then conduct weekly run time tests to determine if any of the demolition activities have compromised performance of the remaining pneumatic system. All run time test results shall be filed with the owner's representative.
  - d. At the completion of the BMS commissioning, after all pneumatic controls have been changed out, the air compressor shall be removed and returned to the school district.
- B. BMS Wiring: Install new wiring and network devices as required to provide a complete and workable control network to satisfy the requirements of Sections 230900 and 230993 and the contract drawings.
  1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
  2. All conduit, fittings, hangers and accessories for control wiring installed under the HVAC Contract shall conform to the levels of quality specified under Division 26.
  3. All wiring shall be installed in conduit, and conduit shall be concealed in finished areas, except as hereinafter specified. Power or interlock wiring shall be run in separate conduit from sensor wiring.
  4. All new construction thermostat drops shall be installed utilizing conduit with an electrical wall box installed within the wall construction. NO EXCEPTIONS. All wall thermostats and wall sensors located in non-public areas shall be mounted with centerline 42" above the finished floor to comply with ADA mounting height requirements. All thermostats and wall sensors located in restrooms, corridors and other public areas shall be mounted with centerline 7'-0" above the finished floor.

5. All low voltage conductors shall be types as herein indicated. Other types and sizes required by the temperature control manufacturer shall be submitted for approval. Low voltage two conductor wire shall be black twisted (six turns per foot) 16 AWG or 18 AWG wire, as indicated, 1/32, 80 degrees C., 600 volt PVC insulation. Low voltage three conductor wire shall be red, yellow, blue twisted (six turns per foot) 16 AWG or 18 AWG wire as indicated, 1/32, 80 degrees C., 600 volt PVC insulation. Cable shall be as manufactured by Alpha Wire Company, Belden Wire Company, Standard Wire and Cable or approved equal.
  6. All control wiring outside of control panels shall be run in rigid conduit or EMT and installed in strict accordance with the requirements of The National Electrical Code. Wiring for the control system, except the low voltage conductors, shall be single conductor solid or stranded copper not less than No. 14 AWG, with 600 volt Type THHN insulation, except where the manufacturer requires special types and sizes. Flameproof insulation shall be used where required by the NEC. Wiring for DDC system inputs/outputs shall be No. 18 two conductor with shield installed in accordance with the requirements of The National Electrical Code. Wiring for DDC system communication trunk shall be 2 conductor, 24AWG, stranded shielded low capacitance cable. All wiring in panel construction may be No. 16 or No. 18 AWG copper as recommended by the manufacturer provided same is properly protected and/or is in accordance with the NEC. No temperature control wiring installed under this contract shall be installed in the building lighting and power circuit systems. Communication trunk wiring shall not be installed in raceway and/or enclosures containing Class 1 or other Class 2 wiring.
  7. Conduit shall be supported from or anchored to structural members. Conduit supported from or anchored to piping, duct supports, the ceiling suspension system, is not acceptable.
  8. If BMS power requirements exceed circuit capacity or circuit quantity as provided by the contract documents, the BMS contractor shall then extend additional power wiring, complete with required breakers, from an electrical panel, as approved by the professional, at no additional cost to the owner. Where an ATC device requires power and no trade is noted as providing that power on the contract documents, the BMS Contractor shall provide all required power wiring, complete with breakers (where required), from an electrical panel as approved by the professional, at no additional cost to the owner.
  9. Where 24 VAC power is required for terminal device controllers, the BMS Contractor shall also be responsible for providing a power box to transform the available 120 VAC. Multiple controllers may be powered from the same power box.
  10. The BMS contractor shall provide sealing and/or fire-stopping for all conduit/wiring penetrations as required.
- C. All sensing elements located in water lines or tanks shall be provided with stainless steel separable sockets. The BMS Contractor shall select the proper location for each separable well and shall provide written installation directions to the mechanical contractor for installation. Sensing elements installed in ducts shall be securely anchored, and when long or averaging sensing elements are used the elements shall be strung through the duct to ensure representative cross sectional sampling

- D. Temperature sensing and limit devices shall be provided in quantities as required to adequately cover the surface area (1 lineal foot of element for 1 square foot of coil area) of the coil involved. While the contract documents may often indicate that multiple devices are required for a particular coil, not all locations requiring multiple devices are so indicated on the contract documents. The BMS Contractor shall be responsible for field verification of coil surface areas involved and providing the required number of sensing and/or limit devices at all locations, regardless of any quantity omission from the contract documents. Series, parallel or series/parallel circuit reduction to a single input shall not be permitted. NO EXCEPTIONS.
- E. Where supply air discharge temperature sensors are located downstream of duct mounted heating coils, the BMS Contractor shall mount the temperature sensor a minimum of six (6) feet from the coil discharge.
- F. Automatically controlled dampers shall be provided complete by the Mechanical Contractor. The control manufacturer shall furnish and install operators for the dampers. In all instances, the BMS Contractor shall provide the quantity of actuators required to supply the torque requirements specified by the damper manufacturer.
- G. All room temperature sensor locations indicated on the drawings are meant to convey the functional requirement that a temperature sensor is needed rather than provide exact location information for that sensor. The BMS contractor shall coordinate with the owner's representative in selecting a representative location within the space involved that avoids interference from furniture, equipment, diffuser location, etc. The BMS Contractor shall likewise provide room temperature sensors and coordinate their location where sensors are required to provide functionality but are not indicated on the drawings.
- H. The BMS Contractor shall coordinate with the owner's representative to determine the room temperature sensor functionality (sensor only, sensor with unoccupied override, sensor with setpoint adjust, sensor with setpoint adjust and unoccupied override, sensor with display, sensor with unoccupied override and display, sensor with setpoint adjust and display, sensor with setpoint adjust and unoccupied override and display, etc.) required at each sensor location. This coordination shall occur prior to shop drawing submittal and the results shall be incorporated in the submittal in tabular matrix format.
- I. The BMS contractor shall coordinate the final location of all BMS control panels indicated on the contract documents with the Mechanical Contractor, the Electrical Contractor and the owner's representative. Such coordination shall take place prior to the BMS Contractor beginning field installation work for the Building Management System and shall become a matter of record in the job meeting minutes for the meeting immediately preceding the start of Building Management System installation.

- J. All BMS controllers, panels and input/output interface panels shall be identified with black laminated plastic nameplates with white lettering. All BMS controllers shall also have black laminated plastic tags with white lettering identifying controller IP address. Controller panel identification shall be the same as used on the control drawings such that it can be easily cross referenced with as-built drawings, and shall also include system, area served, etc. All items of equipment within input/output interface panels shall be labeled with an identification that also corresponds with as-built drawings. All items mounted on the face of input/output interface panels shall be identified with black laminated plastic nameplates with white lettering. Identification shall include function and position information where applicable. All field devices shall be identified with black laminated plastic nameplates with white lettering secured with either double-backed tape or metallic strapping. Identification shall be same tag symbol as found on the as-built drawings and shall also include system, area served, etc. In addition, control devices shall also include range data (as applicable) and signal type (4-20 mA, Open/Closed, etc.) information.
- K. The BMS Contractor shall provide software to be loaded on the Balancing Contractor's computer for use in balancing the VAV system. The Balancing Contractor shall be responsible for delivering his computer to the BMS Contractor's office to have the software loaded and at the same time receive training on proper use of the software package. During the project, the BMS Contractor shall provide additional telephone support to the Balancing Contractor on proper use of the software package. At the end of the project, the Balancing Contractor shall be responsible for delivering his computer back to the BMS Contractor's office to have the balancing software deleted.
- L. In addition to any balancing and/or start-up assistance specified elsewhere in this section of the specifications, the BMS Contractor shall include in his bid three (3) days of on-site technician time to aid the Balancing Contractor in using the DDC system to configure required modes of operation for testing purposes. This time shall be consumed in full day increments, not necessarily concurrent, and must be scheduled with the BMS Contractor a minimum of one (1) week in advance of the actual need date. Should the Balancing Contractor require additional assistance, he shall be responsible for compensating the BMS Contractor on a time-and-material basis.
- M. Fan System Safeties:
1. Each safety shall be wired to its associated BMS controller I/O panel to operate a discrete multi-pole relay. Each safety shall be wired as normally closed and energize its associated multi-pole relay coil under normal conditions. One set of relay contacts shall be wired as an input into the BMS to provide safety status. Another set of contacts shall be series hardwired with the other associated fan safeties to provide a fan system hardwired safety shut-down.
  2. Hardwired Safeties and Stop/Start Relays: It is the intent of this project that any and all hardwired safeties and stop/start relays are all terminated in the new system I/O panels associated with the controller for each system. The exception to this will be the fire alarm system interface modules provided by the fire alarm system contractor, which shall be mounted near each respective starter or VFD.
  3. Where existing smoke detectors do not provide the required number of auxiliary contacts to achieve the specified functionality, the BMS Contractor shall provide interface relays with the proper number of poles to supplement the existing smoke detector auxiliary contact(s).



- N. The Controls Contractor shall have on-site personnel capable of making programming changes and graphics changes to the BMS throughout the commissioning process.
- O. The Controls Contractor shall provide a full complement of software tools and associated training (and hardware where proprietary devices are involved) for use by the Commissioning Agent. The Commissioning Agent shall return all tools to the Controls Contractor at the end of the Commissioning Agent's involvement with the project.
- P. The contract documents require a combination of hardwired VFD points and VFD points available through the drive communication interface. The BMS Contractor shall not eliminate the hardwired points and use the communication interface instead. Hardwired points are to remain. NO EXCEPTIONS.
- Q. A single symbol for electric/electronic actuator(s) indicated on the drawings for damper control is not meant to indicate that only one actuator is required. Rather, it indicates that electric/electronic actuation, in the required quantity, is to be provided at that location. In all instances, the BMS contractor shall provide the quantity of actuators required to supply the torque requirements specified by the damper manufacturer.
- R. All air system and all water system setpoint values shall be coordinated with the TAB Contractor to determine final operating parameter setpoints. All hardwired safety setpoints shall be field verified with the TAB Contractor.
- S. Where the contract documents indicate multiple occupancy sensors associated with the same supply/return/exhaust air system, the BMS Contractor shall wire the occupancy sensor auxiliary contacts reserved for the BMS system in parallel and provide a single digital input (DI) to the associated BMS controller.
- T. In the event that a controller cannot be located in the RTU, the BMS contractor shall be responsible for extending the power circuit as required to the new controller location at no additional cost to the owner.
- U. Duct static pressure sensor locations indicated on the drawings are meant to convey the functional requirement that a sensor/transmitter is needed rather than provide exact location information for that sensor/transmitter. Final location to be verified with the Testing and Balancing Contractor and/or the Commissioning Agent prior to installation.
- V. Differential pressure sensor locations indicated on the drawings are meant to convey the functional requirement that a sensor/transmitter is needed rather than provide exact location information for that sensor/transmitter. Final location to be verified with the Testing and Balancing Contractor and/or the Commissioning Agent prior to installation.
- W. Provide control products, communication media, connectors, switches, repeaters, hubs, and routers as required to comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.
- X. BMS Contractor shall clean up all debris resulting from his activities daily. BMS contractor shall remove all cartons, containers, crates, etc. under his control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Construction Manager or General Contractor. At the completion of work in any area, BMS Contractor shall clean all of his work, equipment, etc., making it free from dust, dirt and debris, etc.

- Y. At the completion of work, all equipment furnished under this Section shall be checked for paint damage, and any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

### 3.3 START-UP AND CHECK-OUT PROCEDURES

- A. The BMS Contractor shall be responsible for developing test plans and procedures to establish that the BMS system functions as described in the Sequence of Operations. The methodology shall address the observations, measurements, adjustments, calibrations and corrections necessary to accomplish the commissioning process. A detailed item-by-item procedure shall be followed for each item of HVAC equipment. Forms used by the BMS Contractor to record the results of the start-up and check-out procedures shall be available for review by the Professional and the owner.
- B. The procedures following shall, as a minimum, incorporate the intent of the following guidelines:
1. Where weather-dependent procedures are checked by simulation, the Contractor shall also verify the actual results in the appropriate weather condition and/or season.
  2. Signals used to change the mode of unit operation shall originate from the actual control device intended for that purpose. Simulation may be used to cause the mode to change. All relay contacts, indicating lights and so on shall be checked for proper functioning with each operational mode change signal.
  3. All sensing elements and transmitters shall have an accuracy check of their calibration performed by comparing the ATC panel level readout with the actual value of the variable measured at the sensing element/transmitter location. All test instruments shall be traceable to NBS standards. Multiple comparisons shall be required for averaging-type sensing elements.
  4. Each HVAC system shall first be observed in the shutdown condition. The HVAC control panel shall be checked for power availability and dampers and valves shall be checked for normal position. Proper operation of all actuators and positioners shall also be checked while the HVAC system is in the shutdown condition. The control signal shall be varied from one extreme to the other and actuator travel from zero stroke to full stroke shall be verified. In addition, it shall be verified that the actuator moves the connected device in the proper direction from one extreme position to the other.
  5. Unit operation shall then be verified in the warm-up/cool-down mode, the occupied mode and the unoccupied mode, as well as during transition between modes. Proper damper and valve position shall be verified during each mode and proper operation of the control loop(s) shall be demonstrated by slightly changing controller inputs, outputs and/or setpoints. Proper operation of sensors used for night setback/setup operation shall be verified by changing setpoints and observing proper unit operation as previously described. Trends using appropriate sample intervals shall be used to document proper system performance.

6. Differential pressure switch, current switch, freezestat, firestat, and smoke detector operation shall be verified via simulation while the associated unit is running. Simulation shall be accomplished without any false alarms to the Life Safety system. Proper contact output at the DDC panel location shall be verified for all hardware simulation. In addition, proper control device actions and interlock functions as described in the Sequences of Operation shall be verified. Proper system operation shall also be verified as the devices are reset. Trends using appropriate sample intervals shall be used to document proper system performance.
- C. Where Maintenance Time Reminders, Change-of-State Alarms, Analog Limit Alarms, etc. are to be provided, the BMS Contractor shall verify that each message is sent to the appropriate output device whenever the trigger condition occurs.
- D. Where graphics are being provided, the BMS Contractor shall verify that all links from dynamic point displays to the actual hardware and software points are correct. This verification shall involve using each graphic screen to make all setpoint changes, schedule overrides, control overrides etc. and verify that the appropriate changes to the control hardware and panel databases take place.
- E. Where implemented trends at the panel level and/or the HMI computer level are to be provided, the BMS Contractor shall demonstrate successful implementation via actual printout of the data being gathered in the case of panel trends, and display, archiving and printout of trend data being gathered at the HMI level.

### 3.4 COMMISSIONING

- A. As part of the work of this project, the BMS Contractor shall be responsible for providing all labor and materials required to satisfy the "commissioning responsibilities of the Controls Contractor" as further defined in Section 238500 – Mechanical Systems Coordination with Commissioning Agent. Commissioning Package shall be compiled which includes all commissioning documentation as well as a summary of the commissioning results.

### 3.5 TRAINING

- A. BMS Contractor shall provide 16 Hours of on-site training, broken down into 4-hour sessions, by a system technician who is fully knowledgeable of the specific installation details of the project. This training shall be "hands' on" type. A mutual agreement on the scheduling of this training class will be made between the Owner and the BMS Contractor. The intent of this training is that 8 hours will occur before the Owner has accepted the project and the rest is to follow shortly thereafter.
- B. The training class will use the actual Operator & Maintenance manual that will be submitted for this project.
- C. As a minimum, this training will cover the following topics:
  1. System Overview
    - a. Architecture and Function

2. System Operation

- a. System Access
- b. Operation Monitoring
- c. Exception Reporting and Acknowledge
- d. Operation Override
- e. Scheduling
- f. Editing Programmed Variables

D. The training class will cover topics in a "hands-on" mode.

E. Proper and adequate documentation must be provided, this will include:

- 1. Accurate as-built drawings and sequences submitted in hard copy and electronic form (the electronic form can be easily updated via a standard Computer Aided Drafted (CAD) program).
- 2. Technical specification sheets
- 3. Signed software license agreement (as required)
- 4. Operator & Maintenance (O & M) manuals
- 5. Warranty statement

3.6 WARRANTY ACCESS

A. The Owner shall grant to the Contractor, reasonable access to the BMS system during the warranty period. The Owner shall provide, at no cost to the Contractor, a public IP address for the Workstation Server Hardware Station for remote telecommunication during this period. This connection shall be for use by the BMS Contractor with authorization for use by the Owner, the Commissioning Agent and Professionals. The BMS Contractor shall provide appropriate and different passwords for use by the Owner, the Commissioning Agent and the Professionals for remote web based access to the BMS system during the construction period and during the warranty period. Should any additional hardware or software be required to provide functionality as herein defined, the BMS Contractor shall furnish and install such required software and hardware in separate locations for the Owner, the Commissioning Agent and Professionals as further directed by the Owner and Professionals.

B. Internet connection shall provide the following functions:

- 1. Access to the entire facility control system by the Contractor to provide service and diagnostic support.
- 2. Complete remote access to all programming tools
- 3. Auto email notification of desired alarms to a remote site.
- 4. During the construction period remote web based access by the Owner, the Commissioning Agent and Professionals shall be limited to viewing individual system trends, viewing individual system graphics and viewing all system alarms. These capabilities shall be provided for each system as soon as a system is placed into operation, even if operation is on a temporary basis.
- 5. During the warranty period remote web based access by Owner, the Commissioning Agent and Professionals shall include full system access to all specified BMS system features and functionality for all connected systems.

### 3.7 APPLICATION DEVELOPMENT AND REVIEW

- A. The contract documents and the sequences of operation are for conveying general concept only and are not meant to be inclusive of all hardware requirements or all functional sequence requirements. Refer to the complete package of contract drawings. Items mentioned in Sections 230900 and 230993, shown on the contract documents, mentioned in the sequences of operation, or shown on other HVAC drawings shall become part of the work of this project without the necessity of being separately detailed in each of those applicable sections of the contract documents. Reference in one section of the contract documents shall be interpreted to include reference in all other applicable sections. Any additional hardware and/or software required to accomplish functional intent shall be provided (without additional cost to the owner) just as though it were fully detailed throughout the contract documents.
- B. The BMS Contractor shall be responsible for providing complete detailed sequences of operation for each piece of equipment or system regardless of the completeness and clarity of the sequences in the contract documents. These detailed sequences shall address all operating modes including, but not limited to, normal, failure, failure recovery. These detailed sequences shall also address all system interaction and operational interfaces and shall be required prior to beginning implementation of the application software and MMI package. The sequences of operation as written infer certain additional functionality in order to accomplish project intent. With that in mind, software review meetings shall be held with the Engineer, Owner, Commissioning Agent and BMS Contractor to finalize details prior to beginning implementation of the application software and MMI package and again at regular intervals during initial operation of the system. Engineer and/or Commissioning Agent shall coordinate scheduling and recording keeping. Following is a summary of anticipated review meetings and required follow-up actions by the BMS Contractor.
1. Review scope of software to be implemented. This shall be an interchange of ideas and operating characteristics of the equipment and facility. All data relative to system operations and design criteria shall be presented at this time. The BMS Contractor shall gather this data and structure the required software around this information. This shall occur prior to starting any software programming by the control installer. This meeting shall also establish the system and point naming conventions to be used throughout the project by the BMS Contractor. Naming conventions shall be approved by the Engineer and the Owner. Graphical screen hierarchy, layout, functionality and operator interaction, including alarming and trending, shall be presented for approval by the Engineer and the Owner.
  2. After one (1) to three (3) months of cooling system operation, as deemed appropriate by any party, an operations/software review shall be held. Any changes required shall be implemented by the BMS Contractor after this meeting.
  3. Prior to the beginning of the next cooling season, a final cooling season software review shall be held to review the operational sequences, resolve any issues that may have occurred and/or implement desired software changes to enhance the system operation.
  4. After one (1) to three (3) months of heating system operation, as deemed appropriate by any party, an operations/software review shall be held. Any changes required shall be implemented by the BMS Contractor after this meeting.
  5. Prior to the beginning of the next heating season, a final heating season software review shall be held to review the operational sequences, resolve any issues that may have occurred and/or implement desired software changes to enhance the system operation.

6. After one (1) to three (3) months of Air Handling Unit system operations, as deemed appropriate by any party, an operations/software review shall be held. Any changes required shall be implemented by the BMS Contractor after this meeting.
7. Seasonal operations (winter heating & humidification and summer cooling and Dehumidification), shall be reviewed with software changes implemented.
8. Final software reviews shall be held for each system to review the operational sequences, resolve any issues that may have occurred and/or implement desired software changes to enhance the system operation.

END OF SECTION 230900

## SECTION 230933 - SEQUENCE OF OPERATION FOR HVAC CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS, REQUIRED COORDINATION/CLARIFICATIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
- B. All work of this Section shall be coordinated and provided by the single Building Management System (BMS) Sub-Contractor.
  - 1. Throughout these specifications, any reference to “BMS Contractor”, "ATC Contractor", "BAS Control Contractor", "Controls Contractor" or “local field office” shall be interpreted as referring to the Building Management System (BMS) Contractor who shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems as further defined for this project in the contract documents.
- C. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other sections/trades. Reference all Division 23 and Division 26 Sections.
- D. The work of this Section shall be as required by the Specifications, Drawings, Point Schedules, Sequences of Operation and Mechanical Systems Commissioning activities.
- E. The contract documents and the sequences of operation are for conveying general concept only and are not meant to be inclusive of all hardware requirements or all functional sequence requirements. Refer to the complete package of contract drawings. Items mentioned in Sections 230900 and 230993, shown on the contract documents, or mentioned in the sequences of operation shall become part of the work of this project without the necessity of being separately detailed in each of those applicable sections of the contract documents. Reference in one section of the contract documents shall be interpreted to include reference in all other applicable sections. Any additional hardware and/or software required to accomplish functional intent shall be provided (without additional cost to the owner) just as though it were fully detailed throughout the contract documents.

- F. Where a unit is provided with manufacturer furnished (factory) controls, the unit manufacturer shall be responsible for evaluating the requirements of the contract documents sequences of operation and defining the read/write operations between the BMS and the factory controls that will be required in order to implement those sequences. Where the BMS vendor will be required to provide/install field hardware to supplement the factory controls, the unit manufacturer will be responsible for providing that information to all BMS vendors listed in the project specifications no later than five (5) days before the bid due date. The manufacturer's control engineer shall meet (telephone conference calls will be acceptable) with the BMS vendor's application programmer, in the presence of the Professional, to define and coordinate those read/write communication requirements and provide a hardcopy record for the project O & M Manuals. The Professional shall continue those discussions as necessary in order to establish that both parties understand their responsibilities in relation to the final working product. Should this coordination not take place, the unit manufacturer shall be responsible for reimbursing the Professional, at standard billing rates, for all time spent researching any field start-up, check-out and commissioning problems that are traced to a lack of the prerequisite coordination defined above. The equipment manufacturer and BMS Contractor shall provide any and all package control system modifications required, up to and including complete replacement of the factory provided controls, in order to provide satisfactory system operation acceptable to the Owner and the Professional. NO EXCEPTIONS.
- G. The unit manufacturer shall be responsible for determining that the factory controls, with proper communication to/from the BMS, are capable of implementing the sequences of operation as defined by the contract documents. Results that merely "approximate the intent" of the required sequences of operation are not acceptable. NO EXCEPTIONS. In addition, the unit manufacturer shall be responsible for maintaining the read/write coordination requirements, as defined for the initial construction process, throughout a ten (10) year period that begins with the start of the warranty period. Any updates to the factory controls during this ten (10) year period shall not require any reprogramming on the part of the BMS vendor. Should any reprogramming be required by the BMS vendor, the unit manufacturer shall be responsible for reimbursing the BMS vendor, at standard billing rates, for all time spent to accomplish the required reprogramming.

## PART 2 – PRODUCTS

### 2.1 NOT APPLICABLE TO THIS SECTION

## PART 3 – EXECUTION

### 3.1 SEQUENCE OF OPERATION

#### A. OCCUPIED/UNOCCUPIED CHANGEOVER

1. The DDC system shall provide warm-up/cool-down/occupied/ unoccupied changeover for the zones indicated below. Zone temperature sensors shall function to provide representative space temperature information for each zone to the DDC system. The DDC system shall optimize changeover times based on zone temperature. Each zone shall be provided with its own discrete optimization program. Exhaust fans shall not be energized



until Occupied time. Zoning scheme shall be approved by the Owner prior to implementation of any application programming by the BMS Contractor.

- a. Baggage Claim Area (RTU-1 and 3)
  - b. Office Area (RTU-2, existing EF-2 and 3)
  - c. Office Area (RTU-4, existing EF-1 and 4)
  - d. Security Screening Area (RTU 5 and 6)
  - e. Office Area (RTU-7)
  - f. Two (2) additional zones as determined by the owner
2. The DDC system shall include provisions, on a per zone basis, for the user to enter an override time interval which will cause the zone to operate in the occupied mode when it was otherwise scheduled to be in the unoccupied mode.
  3. The DDC system shall include Holiday Schedule provisions. Holiday Schedule scheme shall be approved by the Owner prior to implementation of any application programming by the BMS Contractor.
  4. In addition to providing the ability to schedule the zones individually, the BMS Contractor shall provide the ability to schedule all zones from a single schedule. The BMS operator will provide a manual input to the BMS to select between individual and global scheduling options.

**B. OPTIMUM START/STOP**

1. Optimum Start - Heating Mode
  - a. When the outside air temperature is less than the heating changeover temperature and the space temperature is below the occupied heating setpoint, the OSS program shall control in the heating mode.
  - b. Beginning at the maximum start time, OSS shall calculate the time required to bring the controlled space up to the occupied heating setpoint.
  - c. At the calculated start time, the DDC System shall switch the appropriate zone to on. The outdoor air dampers shall remain closed during the warm-up cycle segment of the optimum start process and be released to operate normally at scheduled occupancy (people in the building) time.
2. Optimum Stop - Heating Mode
  - a. At the scheduled vacancy time less the maximum programmed stop time limit, the OSS program shall calculate the heating stop time.
  - b. At the calculated heating stop time, the DDC System shall switch the appropriate zone to the Unoccupied Mode.
3. Optimum Start - Cooling Mode
  - a. When the outside air temperature is greater than the cooling changeover temperature and the space temperature is above the occupied cooling setpoint, the OSS program shall control in the cooling mode.
  - b. Beginning at the maximum start time, OSS shall calculate the time required to bring the controlled space down to the occupied cooling setpoint.
  - c. At the calculated start time, the DDC System shall switch the appropriate zone to on the outdoor air dampers shall remain closed during the cool-down cycle segment of

the optimum start process and be released to operate normally at scheduled occupancy (people in the building) time.

4. Optimum Stop - Cooling Mode

- a. At the scheduled vacancy time less the maximum programmed stop time limit, the OSS program shall calculate the cooling stop time.
- b. At the calculated cooling stop time, the DDC System shall switch the appropriate zone to the Unoccupied Mode.

5. OSS Adaptive Operation

- a. The OSS program shall monitor its heating and cooling performance for each cycle of operation.
- b. Using data obtained during start up, the OSS adaptation program shall modify the OSS operating tables to correct for any errors that may occur and adapt the building's OSS program to the building's mass and thermal characteristics.
- c. Separate calculations and tables shall be maintained for Optimum Start Heat, Optimum Start Cool, Optimum Stop Heat and Optimum Stop Cool.

C. PUMP PRESSURE OPTIMIZATION

The BMS shall continuously monitor the hot water control valve position of all air handling units and terminal heating equipment.

1. At system startup, the pump pressure setpoint shall be 100% (adj.) of the maximum pressure setpoint.
2. When any control valve is more than 95% (adj.) open, the pump pressure setpoint shall be reset upward by 10% of the current pump pressure setpoint at a frequency of every 2 minutes until no valve is more than 95% (adj.) open, or the pump pressure setpoint has reset upward to the system maximum setting, or the pump variable frequency drive(s) are at their maximum setting.
3. When all control valves are less than 85% (adj.) open, the pump pressure setpoint shall be reset downward by 5% of the current pump pressure setpoint at a frequency of every 2 minutes until at least one valve is more than 85% (adj.) open, or the pump's flow rate is equal to the boiler's minimum flow rate, or the pump variable frequency drive(s) are at their minimum setting.
4. The control bands, setpoint increments, setpoint decrements, and adjustment frequencies shall be adjusted to maintain maximum pump pressure optimization with stable system control.
5. The BMS shall have the capability to allow the operator to exclude "problem" control valves that should not be considered when determining the optimized setpoint.
6. Pump Pressure Optimization Enable/Disable Switch: The operator shall have the ability, via the graphics package, to designate when the pump pressure optimization software shall be engaged. A toggle point shall be available to designate this condition. Once the optimization routine has been enabled, it shall remain in operation until the toggle point is manually reset. Separate toggle points shall be provided for the MOB hot water system and the Rink hot water system.
7. During the commissioning process, the BMS contractor shall demonstrate the performance of pump pressure optimization to the satisfaction of the commissioning agent.

#### D. FAN PRESSURE OPTIMIZATION

The BMS shall continuously monitor the damper position of all VAV terminal units. The discharge duct static pressure shall be sensed directly at the discharge of each air handler. The sensor must be mounted in a non-turbulent location. Multiple duct static pressure sensors shall be mounted near the inlet to the most distant VAV boxes in the system as shown on the HVAC drawings. This multiple static sensor arrangement shall be used to limit the reset range of the unit discharge duct static pressure sensor.

1. When any VAV damper is more than 75% (adj.) open, the supply fan discharge duct static pressure setpoint shall be reset upward by 0.1 in W.C. (adj.), at a frequency of 15 minutes (adj.), until no damper is more than 75% (adj.) open, or the static pressure setpoint has reset upward to the system maximum duct static pressure setpoint, or the AHU variable-frequency drive is at the maximum speed setting.
2. When all VAV dampers are less than 65% (adj.) open, the supply fan discharge duct static pressure setpoint shall be reset downward by 0.1 in W.C.(adj.), at a frequency of 15 minutes (adj.), until at least one damper is more than 65% open, or the static pressure setpoint has reset downward to the system minimum duct static pressure setpoint, or the AHU variable-frequency drive is at the minimum speed setting.
3. The control bands, setpoint increment values, setpoint decrement values and adjustment frequencies shall be adjusted to maintain maximum static pressure optimization with stable system control and maximum comfort control.
4. The BMS shall have the capability to allow the operator to exclude “problem” static pressure sensors that should not be considered when determining the optimized setpoint.
5. The BMS shall also read the status of the supply air static pressure sensor and display the active duct static pressure reading on the status screen.
6. The BMS shall also identify, and display to the user, the VAV box that serves the Critical Zone (that is, the zone with the most wide-open VAV damper). This information shall update dynamically as the location of the Critical Zone changes based on building load, and duct static pressure setpoint optimization control.
7. Fan Pressure Optimization Enable/Disable Switch: The operator shall have the ability, via the graphics package, to designate when the fan pressure optimization software shall be engaged. A toggle point shall be available to designate this condition. Once the optimization routine has been enabled, it shall remain in operation until the toggle point is manually reset. Separate toggle points shall be provided for each VAV air handling system.
8. During the commissioning process, the BMS contractor shall demonstrate the performance of fan pressure optimization to the satisfaction of the commissioning agent.

#### E. DEMAND CONTROL VENTILATION

1. The BMS shall include a time-of-day schedule to indicate whether a zone is normally occupied or unoccupied. When the schedule indicates that the zone is normally unoccupied, the required outdoor airflow for the zone shall be zero. When the schedule indicates that the zone is normally occupied, the required outdoor airflow for the zone shall equal the design outdoor airflow (based on design occupancy), unless the zone is equipped with an occupancy sensor and/or a carbon dioxide (CO<sub>2</sub>) sensor that functions as an input to the BMS.
2. RTU's and AHU'S: The outdoor-air dampers shall be controlled to deliver required outdoor airflow at all load conditions. Subject to following paragraphs, the outdoor airflow setpoint shall be determined according to ASHRAE Standard 62-2001, Equation 6-1. On

RTU's and AHU's only, the actual outdoor airflow shall be sensed at the outdoor air intake as further defined in the points list.

**F. VAV BOX AUTO CALIBRATION**

1. The BMS shall provide the ability to automatically commission and calibrate the VAV Air System. The following tests shall be performed, at a minimum:
  - a. Calibration of the damper
  - b. Verification of the air flow through the VAV box
  - c. Verification of the local reheat performance
2. The BMS shall provide the ability to initiate the auto-commissioning /auto-calibration command directly from the user interface. Special service tools shall not be required
3. The BMS shall provide the ability to stagger the auto-commissioning /auto-calibration sequence for groups of VAV boxes to allow the sequence to be performed during occupied hours, if necessary
4. An auto-commissioning report for the VAV Air System shall be generated that contains the results of the auto-commissioning / auto-calibration tests. This report shall contain, at a minimum, the following information for each VAV box in the system:
  - a. Name of VAV box
  - b. Date and time the VAV box was tested
  - c. Presence of any alarms
  - d. Space temperature
  - e. Space temperature setpoint
  - f. Active airflow (in CFM)
  - g. Active airflow setpoint (in CFM)
  - h. Air valve / damper position when the VAV box reaches 40% of the maximum cooling airflow setpoint
  - i. Air valve / damper position when the VAV box reaches 100% of the maximum cooling airflow setpoint
  - j. Discharge air temperature of the VAV box when the VAV local fan is off (omit if the VAV box does not have a local fan)
  - k. Discharge air temperature of the VAV box when the VAV local fan is on (omit if the VAV box does not have a local fan)
  - l. Discharge air temperature of the VAV box when the hydronic heat is active (omit if the VAV box does not have a local hydronic reheat)

**G. COMMUNICATION INTERFACES**

1. The mechanical or electrical equipment supplier shall provide all required on site time to coordinate, checkout and confirm BMS communication interface operation to the satisfaction of the project BMS contractor. On site visits shall be scheduled by the BMS contractor through the mechanical or electrical contractor as appropriate for the equipment being interfaced to.
2. The mechanical or electrical equipment supplier shall also provide all required on site time to coordinate, checkout and confirm BMS communication interface operation to the satisfaction of the project Commissioning Agent. On site visits shall be scheduled by the Commissioning Agent through the mechanical or electrical contractor as appropriate for the equipment being interfaced to.

## H. SPECIAL SEQUENCE REQUIREMENTS

1. Upon a loss of power, the BMS shall reset all systems as required to begin an organized time delayed (adj.) mechanical system restart. Portions of the BMS network are on UPS power and will be able to retain status information for the equipment that had been selected for operation prior to the power failure.
2. Control algorithms shall incorporate software to automatically limit damper (and control valve) travel based on outdoor air temperature. As the outdoor air temperature changes, the software shall dynamically adjust/reset damper (and control valve) travel limits in order to provide for tighter control. As an example, all air handling unit control algorithms shall include a feature to reduce the amount that the outdoor air damper can open (i.e. move toward the full open position) as the outdoor air temperature drops below 40 DEGF (adj.).
3. The BMS Contractor shall make sure that air handling unit application programs that implement sequences of operation do not overlap operation of the heating and cooling coils such that both coils have their control valves open at the same time.
4. Economizer Change Over:
  - a. On HVAC units with 1 stage of DX cooling and no DX capacity control, the economizers shall be positioned to minimum position at 55 deg. F. (adj.) outdoor air temperature. The DX shall be enabled for use at the same setpoint temperature.
  - b. On HVAC units with 1 stage of DX cooling and DX capacity control, or multiple stages of DX cooling, the economizers shall be positioned to minimum position at 74 deg. F. (adj.) outdoor air temperature. The DX shall be enabled for use at 55 deg. F. (adj.) outdoor air temperature.
5. In rooms where multiple units serve a common room, even if there are multiple space temperature sensors, the DDC system shall utilize one common control loop so that all control functions are controlled by one common control loop. This is to eliminate the units fighting each other while trying to maintain space temperature setpoints.
6. Several sequences hereinafter indicate that a manual override switch (depress for 3 seconds) on the room sensor will activate the occupied mode for a period of one hour (adj.). Locations where this override function is to be provided shall be designated and approved by the Owner prior to implementation of any application programming by the BMS Contractor.
7. All setpoints, parameters, etc. designated as manually adjustable (i.e. adj.) in the following paragraphs shall be directly adjustable from the BMS. The associated graphic screen or a separate setpoint screen, the latter being directly accessible via a transfer point on the original graphic screen or from a tree structure, shall provide for the adjustment function. It shall not be necessary to leave the graphic screen package in order to make the adjustments. NO EXCEPTIONS
8. Hardware safeties (freezestat., firestat, high/low static, etc.) shall be auto reset type. DDC controller software shall include provisions to automatically restart equipment after alarm condition clears. In addition, controller software shall lock-out auto restart capability after a safety trips 3 (adj.) times in a 12 hour period. Auto restart capability lock-out shall be alarmed at the central operator workstation as well as text messaged to designated owner personnel. Smoke detectors shall only be resettable via the fire alarm system.

9. When auto restart capability has been locked out, the operator must also toggle a safety shutdown sequence reset software flag before the DDC system will attempt to restart the air handling unit. The operator should inspect the air handling unit for probable cause of the alarm before toggling the software flag. After the software flag has been cleared, an air handling unit restart sequence can be initiated.
10. Hardware safeties (freezestat., firestat, high/low static, smoke detector, etc.) shall be hardwired to their associated starter, VFD, etc. The hardware terminal device shall include an auxiliary set of contacts for input of alarm condition to the DDC system. Hardware safety alarm trips shall be alarmed at the central operator workstation as well as text messaged to designated owner personnel.
11. The ATC Contractor shall provide all wiring, point mapping, programming, check out and verification by providing a BACnet interface to EACH VFD provided under the Heating Contract. Each VFD shall be provided with BACnet interface card by the VFD supplier. Coordinate BACnet interface type with VFD supplier. Where AO, DO and/or DI points are listed in the points lists for VFD's, these points shall be hardwired DDC system I/O points and NOT COMMUNICATED POINTS – NO EXCEPTIONS.
12. The BMS Contractor shall meet with the owner to determine routing requirements for all alarm information. Particular attention shall be paid to developing a routing procedure that prevents non-critical alarms from impacting critical system operation. The prioritization and routing shall be fully implemented to the satisfaction of the owner.
13. The BMS contractor, working in conjunction with the Professional and owner, shall develop and implement a plan for operating the air handling systems, to the extent possible, to protect the building environment from airborne attack. The mitigation plan shall include provisions for future utilization of a sensor to automatically initiate the protection sequence. In the interim, a graphic screen input shall be used to initiate the protection sequence. In all instances, a manual reset command entered via a graphic screen shall be required to return the air handling systems to the normal mode of operation. The BMS contractor shall make any revisions to the plan implementation scheme as directed by the Professional and owner during the warranty period.
14. Remote Condensing Units:
  - a. The BMS contractor shall be responsible to furnish and install all required wiring from DX coil locations to the condensing unit locations for all required control and interlock wiring such as, but not limited to, wiring to enable/disable the DX cooling and wiring to provide operation of any liquid line solenoid valves.
15. Building Outdoor Air Conditions:
  - a. The BAS system shall monitor the outdoor air temperature, and carbon dioxide at a location where the sun does not shine. These temperature and carbon dioxide sensors shall be used to monitor and control the various sequences of operation as defined throughout this document.

(typical for each location)

AI – Outdoor Air Temperature

AI – Outdoor Air Carbon Dioxide

16. Alarms

\* DENOTES MAINTENANCE TIME REMINDER (MTR)

~ DENOTES CHANGE OF STATE OR ANALOG LIMIT ALARM ( and RETURN TO NORMAL)

All MTR, COS, LIMIT and RTN ALARM information designated in the following I/O points lists shall also be fully implemented as part of the work of this project.

I. AHU – GAS HTG/VENT/DX CLG (RTU – 1 and 3)

1. Warm-up Mode: When indexed to the warm-up mode by the DDC system, the supply fan shall run continuously, the outdoor air dampers (and relief air dampers) shall be closed, the return air damper shall be open, and the space temperature sensor shall control the gas valve(s) on the gas heater to achieve space temperature setpoint. Mechanical cooling shall be disabled.
2. Cool-down Mode: When indexed to the cool-down mode by the DDC system, the supply fan shall run continuously, the outdoor air dampers (and relief air dampers) shall be closed, the return air damper shall be open, and the space temperature sensor shall stage the DX system to achieve space temperature setpoint (adj.). Mechanical cooling shall not be enabled until the outdoor air temperature rises above 55 deg. F. (adj.). Otherwise economizer mode cooling shall be utilized. Gas heating shall be disabled.
3. Unoccupied Mode: When the air handling unit is in the unoccupied mode, the supply air fan shall be de-energized. The outdoor air dampers (and relief air dampers) shall be closed and the return air dampers shall be open. Whenever the space temperature is below night set-back limits (adj.), the unit fan shall function (cycle) as described for the warm-up mode to maintain reduced space temperature setpoint of 60 degrees F. (adj.). Whenever the space temperature is above night set-up limits (adj.), the unit fan shall function (cycle) as described for the cool-down mode to maintain elevated space temperature setpoint of 85 degrees F. (adj.). The unoccupied cooling setpoint shall be capable of being set sufficiently high so as to effectively disable cooling during the unoccupied mode.
4. Heating Mode Occupied Cycle: When indexed to the occupied heating mode by the DDC system, the unit fan shall run continuously, and the modulating outdoor air damper shall be controlled to maintain a minimum outdoor air position. The DX cooling shall be de-energized. When the space temperature is below setpoint (adj.), the gas valve shall open to the gas heater and the outside air damper shall be controlled to maintain a minimum open position. As the space temperature rises to the desired setpoint, gas valve shall close to the gas heater. On a continued rise above space temperature setpoint (adj.), the outside air dampers shall be modulated toward the open position. The economizer shall position up to 100 % outdoor air in order to maintain space temperature setpoint. A mixed air thermostat shall limit the outside air damper if mixed air temperature drops below heating coil scheduled entering air temperature (adj.).
5. Cooling Mode Occupied Cycle: When indexed to the occupied cooling mode by the DDC system, the unit fan shall run continuously, and the modulating outdoor air damper shall be controlled to maintain a minimum outdoor air position. With the outdoor air temperature below economizer enable setpoint (adj.), the economizer shall be modulated, subject to the mixed air low limit control function, to maintain space temperature setpoint. A mixed air thermostat shall close the outside air damper if mixed air temperature drops below setpoint,

and the discharge air temperature sensor shall limit the discharge air temperature from dropping below the heating coil scheduled entering air temperature (adj.). On a rise in the outdoor air temperature above the economizer enable setpoint (adj.), the outdoor air damper shall be positioned to its scheduled minimum outdoor air position, and the mechanical cooling shall be cycled to maintain space temperature setpoint. If mechanical cooling is not available, the outdoor and return air dampers shall modulate in an attempt to maintain mixed air setpoint.

6. Safeties - Smoke Condition: The EC shall furnish and install fire alarm control modules at the fan motor starter to de-energize the fan as per the fire alarm system requirements. When fans are de-energized by the fire alarm system, the BMS shall close the outdoor air dampers (and relief air dampers), open the return air dampers, and de-energize the gas heater(s) and the DX cooling. The BMS shall monitor the status of the fire alarm module(s).
7. The unit discharge air temperature sensor shall also provide low and high limit temperature control functions. On a rise in discharge air temperature above 130 deg. F. (adj.) or a drop-in discharge air temperature below 45 deg. F. (adj.) the BMS shall de-energize the unit and generate an appropriate high or low discharge air temperature alarm. Upon an abnormal supply air condition, the BMS shall de-energize the unit fan, close the outdoor air dampers (and relief air dampers), open the return air dampers, and de-energize the gas heater(s) and the DX cooling.
8. Fan Status: A current sensing switch shall provide proof of fan operation and shall enable control loops.
9. Filter Status: Filter status shall be provided via a differential pressure switch installed across the filter bank. Static pressure probes shall be installed on each side of the filter bank in conjunction with the switch. Copper tubing installed in lieu of static probes is not acceptable. If a differential pressure switch across filter section indicates a dirty filter, an appropriate alarm shall be provided at the BMS.
10. Where required, exhaust fans shall be controlled to operate in conjunction with specific air handling units.
11. Fan Start/Stop Failure: If a supply fan fails to start or stop 60 seconds (adj.) after being commanded to do so, as determined by the status of the appropriate current switch, an appropriate alarm shall be provided at the BMS.
12. Abnormal Temperatures: If any of the supply air, return air, mixed air temperature deviates from normal operating parameters, as determined by the appropriate temperature sensor(s), an appropriate alarm shall be provided at the BMS.
13. Maintenance Time Reminders: Run Time shall be totalized for the individual fans. When pre-determined (adj.) run hours are exceeded, an appropriate maintenance time reminder shall be provided at the BMS.

(Typical for each RTU)

DI – Return Smoke Detector Status ~  
AI – Return Air Temperature ~  
AO - Outdoor/Return Air Damper Control  
AI - Mixed Air Temperature #1 ~  
AI - Mixed Air Temperature #2 ~ (where required by unit size)  
DI - Dirty Filter \*  
DO - Gas Heater Enable / Disable)  
AO - Gas Heater Capacity Control  
DO - DX Cooling Capacity Control (One DO per stage of cooling)  
DI – Cooling Fail Alarm (one per DX circuit) ~



DO - Fan Start/Stop \*  
DI - Fan Status ~  
AI - Supply Air Temperature ~  
DI - Supply Smoke Detector Status ~  
AI - Space Temperature ~

J. RTU - GAS HTG/VENT/DX CLG (RTU -2, 4 and 7)

1. General: Minimum airflow requirements to enable operation of the gas furnace and DX cooling are plug numbers at this point and must be verified with the equipment manufacturer. Only an operator with sufficient access level will be able to access/change those parameters.
2. There shall be two minimum OA damper positions defined for unit operation, one when the supply fan is at full speed and the second when the supply fan is at approximately half speed. The BMS shall linearly reset OA damper position between these two endpoints in response to supply fan speed. When the RTU is indexed to the occupied mode, the BMS shall vary the OA damper position as the supply fan speed changes. The OA damper shall utilize this calculated position as long as the economizer is not suitable for free cooling. Minimum OA damper position references hereinafter shall refer to this dynamic reset function.
3. Total connected box airflow must meet minimum airflow requirements for the gas furnace and/or DX cooling to operate as defined below.
  - a. Gas Heat: The gas furnace from the AHU/RTU shall not be enabled until a minimum of 40% (adj.) of the AHU/RTU scheduled air flow is flowing through the VAV boxes as summed from each VAV box. The BMS shall monitor the temperature rise across the heat exchanger and control the firing rate so that the temperature rise does not exceed the nameplate temperature rise rating.
  - b. DX Cooling: The DX cooling from the AHU/RTU shall not be enabled until a minimum of 30% (adj.) of the AHU/RTU scheduled air flow is flowing through the VAV boxes as summed from each VAV box.
4. Warm-Up Mode: When indexed to the warm-up mode by the DDC system, the supply fan shall run continuously, the exhaust fan shall be off, the outdoor air dampers and relief air dampers shall be closed, the return air dampers shall be open, and the return air sensor shall open the gas control valve(s) and modulate the gas valve to achieve return air temperature setpoint 70 deg. F. (adj.). Mechanical cooling shall be disabled. Fan start-up and control shall be as described hereinafter.
5. Cool-Down Mode: When indexed to the cool-down mode by the DDC system, the supply fan shall run continuously, the exhaust fan shall be off, the outdoor air dampers and relief air dampers shall be closed, the return air damper shall be open, and the return air temperature sensor shall cycle the DX system to achieve return air temperature setpoint 74 deg. F. (adj.). Mechanical cooling shall not be enabled until the outdoor air temperature rises above 55 deg. F. (adj.). Gas heating shall be disabled. Fan start-up and control shall be as described hereinafter.

Economizer Change Over:

- a. On HVAC units with 1 stage of DX cooling and no DX capacity control, the economizers shall be positioned to minimum position at 55 deg. F. (adj.) outdoor air temperature. The DX shall be enabled for use at the same setpoint temperature.

- b. On HVAC units with 1 stage of DX cooling and DX capacity control, or multiple stages of DX cooling, the economizers shall be positioned to minimum position at 74 deg. F. (adj.) outdoor air temperature. The DX shall be enabled for use at 55 deg. F. (adj.) outdoor air temperature.
6. Unoccupied Mode: When the roof top air handling unit is in the unoccupied mode, the supply fan and exhaust fan shall be de-energized. The outdoor air dampers and relief air dampers shall be closed, the return air dampers shall be open. Whenever the space temperature is below night set-back limits (adj.), the unit fan shall function as described for the warm-up mode to maintain reduced space temperature setpoint of 60 degrees F. (adj.). Whenever the space temperature is above night set-up limits (adj.), the unit fan shall function as described for the cool-down mode to maintain elevated space temperature setpoint of 85 degrees F. (adj.). A manual override switch (depress for 3 seconds) will activate the occupied mode for a period of one hour (adj.).
7. The supply fan shall operate continuously during the occupied mode. The exhaust fan shall operate whenever the outdoor air damper reaches the setting of the factory installed damper end switch. The DDC system shall delay 30 seconds (adj.) after receiving fan run status verification before placing the supply fan under control of the remote duct static pressure sensor.
8. Heating Mode Occupied Cycle: When indexed to the occupied heating mode by the DDC system, the unit supply fan shall run continuously, and the modulating outdoor air damper shall be controlled to maintain a minimum outdoor air position (adj). The DX cooling shall be de-energized. When the supply air temperature is below the supply air temperature reset schedule setpoint (adj.), as listed hereinafter, the DDC system shall stage the gas control valve(s) open and modulate the gas valve to achieve supply air temperature setpoint (adj.) and the outside air damper shall be controlled to maintain a minimum open position. As the supply air temperature rises to the desired reset schedule temperature setpoint, the DDC system shall close the gas control valve(s) to the heater. On a continued rise above reset schedule temperature setpoint, the supply air temperature set point shall be maintained with the outside air dampers modulated toward the open position. A mixed air thermostat shall limit the outside air damper if mixed air temperature drops below heating coil scheduled entering air temperature (adj.).
9. Cooling Mode Occupied Cycle: When indexed to the occupied cooling mode by the control system, the unit supply fan shall run continuously, and the modulating outdoor air damper shall open to its scheduled minimum position (adj). With the outdoor air temperature below economizer enable setpoint (adj.), the economizer shall be modulated, subject to the mixed air low limit control function, to maintain supply air temperature setpoint. A mixed air thermostat shall close the outside air damper if mixed air temperature drops below setpoint, and the discharge air temperature sensor shall limit the discharge air temperature from dropping below the heating coil scheduled entering air temperature (adj.). The supply air temperature shall be capable of being reset according to outdoor air temperature, with the reset schedule being fully adjustable from the BMS. The supply air temperature reset schedule shall initially be:

<u>OAT</u>	<u>SAT</u>
40 deg. F. & less	65 deg. F.
80 deg. F. & greater	55 deg. F.

Should 3 or more VAV boxes be in a call for heating the RTU shall enable the gas heat on and reset the supply air temperature up to 65 deg. F. (adj.)

On a rise in the outdoor air temperature above the economizer enable setpoint (adj.), the outdoor air damper shall be positioned to its scheduled minimum outdoor air position, and the mechanical cooling shall be cycled to maintain cooling supply air temperature setpoint. If mechanical cooling is not available, the outdoor and return air dampers shall modulate in an attempt to maintain mixed air setpoint.

10. Dehumidification Control: The DDC system shall maintain return/space humidity at 55% RH maximum (adj.) during summer operation. Space humidity will be determined by a humidity transmitter located in the return air stream. When a dehumidification process is initiated, the DX cooling shall be cycled by a discharge temperature low limit set point of 43 deg. F (adj.) added to the discharge temperature sensor functionality. The dehumidification mode shall be terminated when the unit return air humidity reaches setpoint. (adj.) as sensed by the return air humidity sensor(s). Dehumidification will be disabled whenever the outdoor air temperature drops below 55 deg F (adj.). The DDC system shall modulate the VAV box reheat coil SCR to maintain space temperature setpoint during operation in the dehumidification mode.
11. Supply Fan Duct Static Pressure Control: The remote supply air duct static pressure sensor(s), in conjunction with the unit discharge mounted static pressure sensor, shall modulate the supply air fan variable speed drive to maintain a supply air duct static pressure setpoint of 1.20 in. W.C. (adj.). The duct static pressure transducer shall be referenced to the service space via a space type shielded static pressure probe. The VFD speed shall be varied as required to maintain remote static setpoint subject to the high supply fan static pressure limit.
12. Exhaust Fan Control: The exhaust fan is started and stopped based on outdoor air damper position. Once started, the exhaust fan blows against backdraft dampers which open to exhaust the air.
13. Safeties - Supply/Return Air Smoke Condition: Existing smoke detectors shall be reused. The BMS contractor shall monitor the status of each of these detectors. When fans are de-energized by the fire alarm system, the BMS shall close the outdoor air dampers, open the return air dampers, de-energize the gas heater and de-energize the DX cooling.
14. The unit discharge air temperature sensor shall also provide low and high limit temperature control functions. On a rise in discharge air temperature above 110 deg. F. (adj.) or a drop in discharge air temperature below 43 deg. F. (adj.) the BAS shall de-energize the unit and generate an appropriate high or low discharge air temperature alarm. Upon an abnormal supply air condition the gas heating and DX cooling shall de-energize, the outside air damper shall close and the unit fans de-energize.
15. Fan Status: A current switch shall provide proof of fan operation and shall enable control loops.
16. Filter Status: Filter status shall be provided via a differential pressure transmitter installed across the filter bank. If a differential pressure transmitter across filter section indicates a dirty filter, an appropriate alarm shall be provided at the BMS.
17. Fan Start/Stop Failure: If a supply fan or return fan fails to start or stop 30 seconds (adj.) after being commanded to do so, as determined by the status of the appropriate current switch, an appropriate alarm shall be provided at the BMS.
18. Abnormal Temperatures: If any of the supply air, return air, mixed air temperature deviates from normal operating parameters, as determined by the appropriate temperature sensor(s), an appropriate alarm shall be provided at the BMS.

19. Maintenance Time Reminders: Run Time shall be totalized for the individual fans. When pre-determined (adj.) run hours are exceeded, an appropriate maintenance time reminder shall be provided at the BMS.

AI – Return Air Temperature ~  
DI – Return Air Smoke Detector FACMR Status ~  
DO – Exhaust Fan Start/Stop \*  
DI – Exhaust Fan Status ~  
DI – Exhaust Fan Fire Alarm Shut Down FACMR Status ~  
AO – Outdoor/Return Air Damper Control  
AI – Mixed Air Temperature ~  
AI – Dirty Filter \*  
DO – Gas Heat Stage #1 Control  
DO – Gas Heat Stage #2 Control  
DO – DX Cooling Stage #1 Control  
DO – DX Cooling Stage #2 Control  
DO – Supply Fan Start/Stop \*  
DI – Supply Fan Status ~  
AO – Supply Fan Speed Control  
AVs – Analog Values from RTU Communication Interface.  
BVs – Binary Values from RTU Communication Interface.  
DI – Supply Fan Fire Alarm Shut Down FACMR Status ~  
AI – Supply Air Temperature ~  
DI – Supply Air Smoke Detector FACMR Status ~  
AI – Remote Duct Static Pressure ~  
AVs - Space Temperatures  
AVs - Space Temperature Setpoints  
AVs – Call for Heat  
DVs - VVB Override Push-buttons

K. VARIABLE VOLUME BOX – WITH PROPORTIONAL ELECTRIC REHEAT

1. The BMS Contractor shall use the supply airflow sensor to implement a “softwired” interlock to both verify sufficient airflow to enable the electric heat to operate (i.e. function in conjunction with the airflow switch interlock) and then limit electric heater capacity according to available airflow and ASHRAE recommended discharge limits.
2. The BMS Contractor shall use the discharge air temperature sensor to limit operation of the electric reheat coil to maintain the discharge air temperature within range of 20 degF (adj.) +/- 5 degF (adj.) above zone heating setpoint.
3. Where the associated AHU/RTU is equipped with gas heat and/or DX cooling, total connected box airflow must meet minimum airflow requirements for the gas furnace and/or DX cooling for those systems to operate. Refer to VAV RTU Sequences of Operation for additional information.
4. The BMS Contractor shall provide a control algorithm that also defines reheat minimum and reheat maximum flow values (adj.) in addition to the minimum flow (adj.) and maximum flow (adj.) values for the VAV box (i.e. there will be separate minimum and maximum flows for the heating and cooling modes of operation). The reheat flow CFMs shall take into account the manufacturer’s recommendation for minimum airflow when operating in the electric reheat mode. During the cooling mode of operation, VAV box flow shall increase from cooling minimum flow to cooling maximum flow as the space

- temperature increases through the cooling throttling range centered around the cooling setpoint. During the heating mode of operation, the first stage of heating shall consist of modulating the zone supply air temperature setpoint (maximum of 95 degF (adj.)) while maintaining reheat minimum airflow. The second stage of heating shall consist of modulating the airflow rate from the reheat minimum toward the reheat maximum while maintaining supply air temperature. Heating and cooling setpoints shall be such that the heating setpoint cannot occur within the cooling throttling range.
5. The control algorithm shall also be capable of limiting heater capacity according to available airflow rate.
  6. In areas with auxiliary base board heat in conjunction with VAV's, the auxiliary base board shall be the first stage on and the last stage off, with the VAC being the second stage on and the first stage off.
  7. Warm-up Mode: The DDC network shall initiate the warm-up mode for the DDC VAV boxes. In the warm-up mode with the space temperature below the morning warm-up setpoint, the controller shall provide maximum reheat CFM to the area served and control the SCR electric reheat, as required, to supplement the AHU supply air temperature (while limiting the reheat discharge air temperature to 20 degF (adj.) +/- 5 degF (adj.) above zone heating setpoint) in order to achieve warm-up setpoint. As warm-up setpoint is approached, the controller shall modulate the SCR to off and then modulate the CFM toward its minimum setting (box flow shall be adjusted as required to maintain AHU minimum flow requirements). The warm-up mode shall be terminated locally at the controller when warm-up setpoint is reached, or remotely from the DDC network at zone occupied time.
  8. Cool-down Mode: The DDC network shall initiate the cool-down mode for the DDC VAV boxes. In the cool-down mode with the space temperature above the morning cool-down setpoint, the controller shall provide maximum cooling CFM to area served. As cool-down setpoint is approached, the controller shall modulate the CFM toward its minimum cooling setting (box flow shall be adjusted as required to maintain AHU minimum flow requirements). The cool-down mode shall be terminated locally at the controller when cool-down setpoint is reached, or remotely from the DDC network at zone occupied time.
  9. Occupied Mode: Controller shall modulate damper actuator to maintain local space temperature setpoint within the minimum and maximum air flows as configured within the controller or as provided via the DDC network. During the heating mode of operation (space temperature below setpoint), the first stage of heating shall consist of modulating the zone supply air temperature setpoint (limiting the reheat discharge air temperature to 20 degF (adj.) +/- 5 degF (adj.) above zone heating setpoint) while maintaining reheat minimum airflow. The second stage of heating shall consist of modulating the airflow rate from the reheat minimum toward the reheat maximum while maintaining supply air temperature (limiting the reheat discharge air temperature to 20 degF (adj.) +/- 5 degF (adj.) above zone heating setpoint). During the cooling mode of operation (space temperature above setpoint), VAV box flow shall increase from minimum flow to maximum flow as the space temperature increases through the cooling throttling range. Where auxiliary heating is in a room with a VAV box the auxiliary heating shall be the first stage of heat.
  10. Unoccupied mode: The damper actuator shall be positioned to the fully closed position at the end of the occupied mode via the DDC network.
    - When a sufficient number of spaces are calling for heating, the DDC system shall index the air handling unit to the warm-up mode. When the room is indexed to the unoccupied heating mode, the room thermostat will modulate the VAV box open to the reheat CFM and the SCR shall be modulated as required, subject to discharge air

temperature limits described above, to maintain space temperature at 62 deg. F. (adj.) setting. The VAV box will de-energize the SCR and after a two minute (adj.) time delay, close to primary air flow (consistent with maintaining minimum AHU/RTU airflow requirements) when the room temperature exceeds 62 deg. F. (adj.) setpoint.

- When a sufficient number of spaces are calling for cooling, the DDC system shall index the air handling unit to the cool-down mode. When the room is indexed to the unoccupied cooling mode, the room thermostat will modulate the VAV box open to the minimum air flow position to maintain 82 deg F. (adj.) setting. The VAV box will shut off primary air flow (consistent with maintaining minimum AHU/RTU airflow requirements) when the room temperature drops below 82 deg F. (adj.) setpoint.

11. A discharge air temperature sensor shall limit the supply air temperature to the room.
12. The room sensor shall have an integral plug for connection by the balancing contractor for setting the required airflow rates (as defined by the contract documents) for each box. Once the balancing contractor has set the flows, the information may be uploaded to the central system from the balancing contractor's laptop to define final system operating parameters.

(Typical for each box)

AI	Space Temperature ~
AV	Space Temperature Setpoint (From BAS Only)
AO	Damper Control
AI	Box Flow (CFM)
AO	Heating Output
AI	Discharge Air Temperature ~
DO	Auxiliary Heating Control (Where Applicable)
AV	Effective Cooling Setpoint
AV	Effective Heating Setpoint
BV	Occupancy Schedule
AV	Box Flow Setpoint
AV	Cooling Occupied Minimum Flow Setting
AV	Cooling Occupied Maximum Flow Setting
AV	Heating Occupied Minimum Flow Setting
AV	Heating Occupied Maximum Flow Setting
DV	System Mode

L. AHU – GAS HTG/VENT/DX CLG (RTU- 5 and 6)

1. Warm-up Mode: When indexed to the warm-up mode by the DDC system, the supply fan shall run continuously, the outdoor air dampers (and relief air dampers) shall be closed, the return air damper shall be open, and the space temperature sensor shall control the gas valve(s) on the gas heater to achieve space temperature setpoint. Mechanical cooling shall be disabled.
2. Cool-down Mode: When indexed to the cool-down mode by the DDC system, the supply fan shall run continuously, the outdoor air dampers (and relief air dampers) shall be closed, the return air damper shall be open, and the space temperature sensor shall stage the DX system to achieve space temperature setpoint (adj.). Mechanical cooling shall not be enabled until the outdoor air temperature rises above 55 deg. F. (adj.). Otherwise economizer mode cooling shall be utilized. Gas heating shall be disabled.

3. Unoccupied Mode: When the air handling unit is in the unoccupied mode, the supply air fan shall be de-energized. The outdoor air dampers (and relief air dampers) shall be closed and the return air dampers shall be open. Whenever the space temperature is below night set-back limits (adj.), the unit fan shall function (cycle) as described for the warm-up mode to maintain reduced space temperature setpoint of 60 degrees F. (adj.). Whenever the space temperature is above night set-up limits (adj.), the unit fan shall function (cycle) as described for the cool-down mode to maintain elevated space temperature setpoint of 85 degrees F. (adj.). The unoccupied cooling setpoint shall be capable of being set sufficiently high so as to effectively disable cooling during the unoccupied mode.
4. Heating Mode Occupied Cycle: When indexed to the occupied heating mode by the DDC system, the unit fan shall run continuously, and the modulating outdoor air damper shall be controlled to maintain a minimum outdoor air position, subject to CO2 Control. The DX cooling shall be de-energized. When the space temperature is below setpoint (adj.), the gas valve shall open to the gas heater and the outside air damper shall be controlled to maintain a minimum open position, subject to CO2 Control. As the space temperature rises to the desired setpoint, gas valve shall close to the gas heater. On a continued rise above space temperature setpoint (adj.), the outside air dampers shall be modulated toward the open position. The economizer shall position up to 100 % outdoor air in order to maintain space temperature setpoint. A mixed air thermostat shall limit the outside air damper if mixed air temperature drops below heating coil scheduled entering air temperature (adj.).
5. Cooling Mode Occupied Cycle: When indexed to the occupied cooling mode by the DDC system, the unit fan shall run continuously, and the modulating outdoor air damper shall be controlled to maintain a minimum outdoor air position, subject to CO2 Control. With the outdoor air temperature below economizer enable setpoint (adj.), the economizer shall be modulated, subject to the mixed air low limit control function, to maintain space temperature setpoint. A mixed air thermostat shall close the outside air damper if mixed air temperature drops below setpoint, and the discharge air temperature sensor shall limit the discharge air temperature from dropping below the heating coil scheduled entering air temperature (adj.). On a rise in the outdoor air temperature above the economizer enable setpoint (adj.), the outdoor air damper shall be positioned to its scheduled minimum outdoor air position, subject to CO2 Control, and the mechanical cooling shall be cycled to maintain space temperature setpoint. If mechanical cooling is not available, the outdoor and return air dampers shall modulate in an attempt to maintain mixed air setpoint.
6. CO2 Damper Control: A space CO2 sensor/transmitter shall provide continuous monitoring of CO2 levels. During the occupied mode, the outdoor air damper control may be overridden by the CO2 sensor to maintain the ventilation air requirements. A space CO2 sensor, through the DDC system, shall function to modulate the outdoor air dampers to the open position, overriding minimum outdoor air requirements, in order to maintain space CO2 levels at 800 ppm (adj.) setpoint. The reverse sequence shall occur on a drop in CO2 level. If mixed air temperature rises, the outdoor air dampers shall modulate open as previously described to maintain setpoint temperature. During the unoccupied mode the CO2 sensor shall have no impact on the respective RTU operation.
7. Safeties - Smoke Condition: The EC shall furnish and install fire alarm control modules at the fan motor starter to de-energize the fan as per the fire alarm system requirements. When fans are de-energized by the fire alarm system, the BMS shall close the outdoor air dampers (and relief air dampers), open the return air dampers, and de-energize the gas heater(s) and the DX cooling. The BMS shall monitor the status of the fire alarm module(s).

8. The unit discharge air temperature sensor shall also provide low and high limit temperature control functions. On a rise in discharge air temperature above 130 deg. F. (adj.) or a drop in discharge air temperature below 45 deg. F. (adj.) the BMS shall de-energize the unit and generate an appropriate high or low discharge air temperature alarm. Upon an abnormal supply air condition the BMS shall de-energize the unit fan, close the outdoor air dampers (and relief air dampers), open the return air dampers, and de-energize the gas heater(s) and the DX cooling.
9. Fan Status: A current sensing switch shall provide proof of fan operation and shall enable control loops.
10. Filter Status: Filter status shall be provided via a differential pressure switch installed across the filter bank. Static pressure probes shall be installed on each side of the filter bank in conjunction with the switch. Copper tubing installed in lieu of static probes is not acceptable. If a differential pressure switch across filter section indicates a dirty filter, an appropriate alarm shall be provided at the BMS.
11. Where required, exhaust fans shall be controlled to operate in conjunction with specific air handling units.
12. Fan Start/Stop Failure: If a supply fan fails to start or stop 60 seconds (adj.) after being commanded to do so, as determined by the status of the appropriate current switch, an appropriate alarm shall be provided at the BMS.
13. Abnormal Temperatures: If any of the supply air, return air, mixed air temperature deviates from normal operating parameters, as determined by the appropriate temperature sensor(s), an appropriate alarm shall be provided at the BMS.
14. Maintenance Time Reminders: Run Time shall be totalized for the individual fans. When pre-determined (adj.) run hours are exceeded, an appropriate maintenance time reminder shall be provided at the BMS.

(Typical for each RTU)

AI – Return Air Temperature ~  
AO - Outdoor/Return Air Damper Control  
AI - Mixed Air Temperature #1 ~  
AI - Mixed Air Temperature #2 ~ (where required by unit size)  
DI - Dirty Filter \*  
DO - Gas Heater Capacity Control (One DO per stage of heating \*\*)  
AI - Gas Heater Discharge Air Temperature ~  
DO - DX Cooling Capacity Control (One DO per stage of cooling)  
DI – Cooling Fail Alarm (one per DX circuit) ~  
DO - Fan Start/Stop \*  
DI - Fan Status ~  
AI - Supply Air Temperature ~  
DI – Supply Fan FACMR Shutdown Relay Status ~  
AI - Space Temperature ~  
AI - Space CO2 Level ~

#### M. IN FLOOR HEATING SYSTEM

1. Floor mounted temperature sensors shall be installed (where noted on the building plans) to initiate the startup of the system. The boiler and the pumps shall operate continuously based upon the need for heat. Once the system is initiated ON, the system shall remain ON for a minimum of 2 hours (adj.).



2. Once enabled, the boiler shall maintain 115 degree (adj.) hot water temperature to the floor. With a hot water pump operating, the boiler shall modulate to maintain supply water temperature. The reverse sequence shall occur as system temperature demand decreases. When there is no call for the boiler, the boiler run around pump shall continue to operate for 10 minutes before stopping.
3. Current sensing relays located in each pump starter shall provide pump proof of operation. Should a pump fail to start after being commanded on by the BMS, the control system shall generate an alarm.
4. High and low temperature supply and return temperature alarms shall be reported to the BMS. High supply temperature alarm (100 degF (adj.)) shall stop the boiler and run around pump.

DI Floor Condition Sensor ~  
AI HWR Temperature Entering Boiler ~  
AI HWS Temperature Leaving Boiler ~  
AI HWR Temperature from Floor ~  
AI HWS Temperature to Floor ~  
DO Pump-1 Start/Stop \*  
DI Pump-1 Status ~  
DO Boiler Run Around Pump Start/Stop \*  
DI Boiler Run Around Pump Status ~  
DO Boiler Start/Stop \*  
DI Boiler Alarm Status ~

N. Ceiling Fan Control - DDC Day/Night Operation

1. Where scheduled on the drawings, a relay shall be provided for general ceiling fans which shall function to allow the DDC system to operate the ceiling fans continuously during the "occupied," "warm-up" and "cool down" cycles of operation and stop the ceiling fan during the "unoccupied" cycle of operation.
2. The ceiling fans speed shall be manually set by the operator.
3. Current sensing relays located in each fan shall provide proof of operation. Should a fan fail to start after being commanded on by the BMS, the control system shall generate an alarm.
4. All power wiring, (except for power wiring from the power panel, through the motor protection/control device to the motor, which shall be by the EC) interlock wiring and control wiring shall be by the BMS Contractor.  
(Typical for each exhaust fan)

DO – Ceiling Fans 1, 2 and 3 Start/Stop \*  
AO – Ceiling Fans 1, 2 and 3 Speed Control  
DI – Ceiling Fan 1 Status ~  
DI – Ceiling Fan 2 Status ~  
DI – Ceiling Fan 3 Status ~  
DO – Ceiling Fan 4 and 5 Start/Stop \*  
AO – Ceiling Fans 4 and 5 Speed Control  
DI – Ceiling Fan 4 Status ~  
DI – Ceiling Fan 5 Status ~  
DO – Ceiling Fans 6 and 7 Start/Stop \*  
AO – Ceiling Fans 6 and 7 Speed Control  
DI – Ceiling Fan 6 Status ~

DI – Ceiling Fan 7 Status ~

O. AIR CURTAIN

1. The air curtain shall operate from a occupancy sensor (provided by ATC). A return air thermostat shall cycle the heat to maintain temperature.

P. ELECTRIC BASE BOARD HEATING

1. The electric base board heating where shown on the drawings shall have self-contained thermostats
2. The electric base board heating where shown on the drawings shall have control relays and shall be controlled by the VAV's

Q. KITCHEN HOOD EXHAUST FAN

1. Kitchen hood manufacturer shall provide hood with a temperature switch and its contacts shall make upon sensing heat within hood. On a rise in temperature above temperature switches setpoint, the exhaust fan shall be energized to operate. On a drop-in hood temperature below setpoint the exhaust fan shall be de-energized. Hood exhaust fan shall operate for a minimum of 15 minutes (adj.) after the hood temperature switch deactivates.
2. The exhaust fan shall be interlocked with the Ansul system such that on an alarm condition with activation of the Ansul system, the hood exhaust fan shall be de-energized, bypassing all time delays. Also, upon activation of the kitchen Ansul system the motor operated damper in the supply air duct serving the kitchen shall close. On return to normal of the Ansul system, the motor operated damper shall return to the open position.
3. All interlock control and power wiring shall be by the ATC contractor.

(typical for each hood exhaust fan)

DI –Fan Status

DI – Hood Temperature Switch Status

DI – Ansul System Status

DO – Hood Exhaust Fan Stop/Start

DO – Kitchen Supply Air MOD Open/Close Command

DI – Kitchen Supply Air MOD Open Position

DI – Kitchen Supply Air MOD Close Position

R. EXHAUST FAN CONTROL - DDC DAY/NIGHT OPERATION

1. Where scheduled on the drawings, a relay shall be provided for general exhaust fans which shall function to allow the DDC system to operate the exhaust fan continuously during the "occupied" cycle of operation and stop the exhaust fan during the "warm-up", "cool down" and "unoccupied" cycles of operation. The exhaust fans shall not run until the DDC system has also commanded the appropriate source(s) of make-up air (unit ventilators, air handling units) for that zone to run in the "occupied" cycle. Control wiring will be furnished and installed by the ATC Manufacturer. A separate digital output point shall be provided for each exhaust fan(s). This digital output shall be in addition to that provided for day/night changeover of other HVAC equipment in that zone.

2. Where appropriate, motor operated discharge dampers shall first open before exhaust fans can be energized. Damper position interlock shall provide a signal that the dampers are proven open and enable the fans to start.
3. All power wiring, (except for power wiring from the power panel, through the motor protection/control device to the motor, which shall be by the EC) interlock wiring and control wiring shall be by the BMS Contractor.

(Typical for each exhaust fan)

DO – Exhaust Fan Start/Stop \*

DI – Exhaust Fan Status ~

S. EXISTING ELECTRIC HUH IN BAGGAGE AREAS

1. Mount a new switch at 4 feet AFF to turn off the unit.
2. Add tag that reads “HUH AUTO – OFF”

T. ALARM REQUIREMENTS

1. All alarm conditions (ALL MTR (\*), COS (~), LIMIT (~) and RTN (~) ALARM INFORMATION DESIGNATED IN THE POINTS LIST) shall be separately annunciated and their occurrence indicated by showing a red alarm icon on the current graphic display. A separate page shall be used to display alarm details. AVs and BVs read/written across 3<sup>rd</sup> party communication interfaces shall also be treated as I/O points for alarming purposes and alarmed as determined by the owner.
2. The BMS Contractor shall meet with the owner to determine routing requirements for all alarm information. Particular attention shall be paid to developing a routing procedure that prevents non-critical alarms from impacting critical system operation. The prioritization and routing shall be fully implemented to the satisfaction of the owner. The ATC contractor, working in conjunction with owner, shall implement automatic email of selected alarms to the designated owner personnel. Additional method(s) of alarm annunciation shall be coordinated with the owner.
3. The BMS Contractor shall provide custom alarm reports as required for this project.
4. The following alarm conditions, as further detailed by the owner, shall also be detected and an appropriate alarm generated.
  - Device failed to start/stop
  - Damper position feedback does not agree with commanded position
  - Control valve position feedback does not agree with commanded position
  - Boiler alarm
  - Boiler E-Stop alarm
  - Boiler communication interface point alarms as determined by owner
  - VFD alarm
  - VFD communication interface points alarms as determined by owner
  - High/low hot water supply temperature
  - High/low hot water system differential pressure
  - Freeze Alarm
  - Dirty filter
  - Smoke detector alarm
  - High/low mixed air temperature

- High/low heating coil discharge air temperature
- High/low cooling coil discharge air temperature
- High/low supply air temperature
- High/low space temperature
- High/low space humidity
- High/low AHU static pressure
- High/low duct static pressure
- High/low space static pressure
- High CO<sub>2</sub> level

U. TREND REQUIREMENTS

1. All I/O points and setpoints shall be linked to trend objects. The controller(s) shall record a trend sample every 15 minutes (adj.) for each trend object and save the most recent 120 (adj.) samples.
2. AVs and BVs read/written across 3<sup>rd</sup> party communication interfaces shall also be treated as I/O points for trending purposes.
3. The BMS Contractor shall provide custom preconfigured and fully implemented trend reports as required for this project.
4. The following trends shall be implemented and automatically archived to the server as part of this project to aid in operating the building for maximum energy efficiency. Point selection shall be consistent with available memory and coordinated with the owner prior to implementation. The BMS contractor, working in conjunction with Owner's Representative, shall implement automatic email of selected trends to the designated Owner's Representative personnel.
  - a. Operating Rooms – temperature, humidity and room pressure trending done for each individual O. R.
  - b. Air handling units – trending done for each individual unit (AHU-1, AHU-2, etc.) number of points and/or trends as determined by the Owner's Representative
  - c. Split Systems - trending done for each individual unit
  - d. Variable volume boxes – representative boxes selected by the Owner's Representative, number of points and/or trends as determined by the Owner's Representative
  - e. Exhaust system – number of points and/or trends as determined by the Owner's Representative
  - f. VFD communication interface points - number of points and/or trends as determined by the Owner's Representative
  - g. Hot water system overview – number of points and/or trends as determined by the Owner's Representative
  - h. Hot water system communication interface points - number of points and/or trends as determined by the Owner's Representative

V. CUSTOM REPORTS

1. Provide custom reports as required by the owner and the professional for this project.

3.2 WARRANTY

- A. The local field office shall warranty the BMS as described in Section 230900, paragraph 1.8 Warranty. The work of this Section will be subject to the warranty requirements of Section 230900, paragraph 1.8 Warranty.

### 3.3 WARRANTY ACCESS

- A. The local field office shall provide warranty access as described in Section 230900, paragraph 3.6 Warranty Access. The work of this Section will be subject to the warranty access requirements of Section 230900, paragraph 3.6 Warranty Access.

### 3.4 APPLICATION DEVELOPMENT AND REVIEW

- A. The control drawings and the sequences of operation are for conveying general concept only and are not meant to be inclusive of all hardware requirements or all functional sequence requirements. Refer to the complete package of contract drawings for equipment quantity and location information. Items mentioned in Sections 230900 and 230993, shown on the control drawings, mentioned in the sequences of operation or shown on other HVAC drawings shall become part of the work of this project without the necessity of being separately detailed in each of those applicable sections of the contract documents. Reference in one section of the contract documents shall be interpreted to include reference in all other applicable sections. Any additional hardware and/or software required to accomplish functional intent shall be provided (without additional cost to the owner) just as though it were fully detailed on the contract documents.
- B. The BMS Contractor shall be responsible for providing complete detailed sequences of operation for each piece of equipment or system regardless of the completeness and clarity of the sequences in the contract documents. These detailed sequences shall address all operating modes including, but not limited to, normal, failure, failure recovery. These detailed sequences shall also address all system interaction and operational interfaces and shall be required prior to beginning implementation of the application software and MMI package. The sequences of operation as written infer certain additional functionality in order to accomplish project intent. With that in mind, software review meetings shall be held with the Engineer, Owner, Commissioning Agent and BMS Contractor to finalize details prior to beginning implementation of the application software and MMI package and again at regular intervals during initial operation of the system. Engineer and/or Commissioning Agent shall coordinate scheduling and recording keeping. Following is a summary of anticipated review meetings and required follow-up actions by the BMS Contractor.
  - 1. Review scope of software to be implemented. This shall be an interchange of ideas and operating characteristics of the equipment and facility. All data relative to system operations and design criteria shall be presented at this time. The BMS Contractor shall gather this data and structure the required software around this information. This shall occur prior to starting any software programming by the control installer. This meeting shall also establish the system and point naming conventions to be used throughout the project by the BMS Contractor. Naming conventions shall be approved by the Engineer and the Owner. Graphic screen hierarchy, layout, functionality and operator interaction, including alarming and trending, shall be presented for approval by the Engineer and the Owner.

2. After one (1) to three (3) months of cooling season operation, as deemed appropriate by any party, an operations/software review shall be held. Any changes required shall be implemented by the BMS Contractor after this meeting.
3. Prior to the beginning of the next cooling season, a final cooling season software review shall be held to review the operational sequences, resolve any issues that may have occurred and/or implement desired software changes to enhance the system operation.
4. After one (1) to three (3) months of heating season operation, as deemed appropriate by any party, an operations/software review shall be held. Any changes required shall be implemented by the BMS Contractor after this meeting.
5. Prior to the beginning of the next heating season, a final heating season software review shall be held to review the operational sequences, resolve any issues that may have occurred and/or implement desired software changes to enhance the system operation.
6. After one (1) to three (3) months of Air Handling Unit system operations, as deemed appropriate by any party, an operations/software review shall be held. Any changes required shall be implemented by the BMS Contractor after this meeting.
7. Seasonal operations (winter heating & humidification and summer cooling and Dehumidification), shall be reviewed with software changes implemented.
8. Final software reviews shall be held for each system to review the operational sequences, resolve any issues that may have occurred and/or implement desired software changes to enhance the system operation.

END OF SECTION 230993

## SECTION 232113 – HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The pipe and fittings for the various HVAC systems shall be as hereinafter described in this section.

### PART 2 - PRODUCTS

#### 2.1 CIRCULATING WATER PIPING

- A. Circulating Water Piping shall include the following:
  - 1. Hot Water Supply and Return (HWS & R)
  - 2. Drain piping
  - 3. Relief valve piping
  - 4. Vent Piping
- B. All new circulating water piping shall be Schedule 40, welded black steel pipe, conforming to ASTM Specifications A53. Weight and dimensions shall conform to ANSI Standard B36.10.
- C. In lieu of using Schedule 40 black steel pipe and fittings for circulating water piping, the Contractor shall have the option of using Type L hard temper copper tubing assembled with wrought copper solder end fittings. Solder shall be 95-5 tin-antimony.
- D. Circulating water piping systems shall be two-pipe forced circulation. Supply and return mains shall be run level. For up-feed connections and risers, branches shall be taken from main with 90 degree top connections and down-feed branches and risers shall be taken from the main with 90 degree bottom connections.
- E. High points and drops of the piping system shall be provided with air vents of type specified in Section 23 0523.
- F. Furnish and install inverted eccentric reducers in horizontal lines where reduction or increase in main size is shown. Top of pipe shall be level.
- G. Ample provision for expansion and contraction of piping on all branch connections from mains and risers shall be provided.

- H. Piping concealed in walls, partitions, above ceilings and other locations shall be tested with air or nitrogen with pressure held at 150 PSIG for two (2) hours. Correction shall be made for changes in ambient temperatures.
- I. Piping connections at the boilers, up to and including the first valve, shall be code welded in accordance with ASME regulations and as required by the State Department of Labor and Industry. Screwed and flanged connections may be made at the boilers where permitted by the State Department of Labor and Industry.

## 2.2 CHEMICAL FEED PIPING

- A. Chemical feed piping shall be Schedule 80 black steel pipe. PVC or polyethylene rigid pipe and fittings may be used where recommended or required by the chemical treatment equipment manufacturer; however, piping must not be subject to high temperatures beyond the capability of the pipe.

## 2.3 COLD WATER MAKE-UP PIPING

- A. From outlets on cold water mains provided by the Plumbing Contractor, furnish and install all cold water makeup piping to the following:
  - 1. Circulating Water Piping
  - 2. Steam Systems
- B. Makeup piping shall be complete with all valves, strainers, backflow preventers, pressure-reducing valves, fittings and insulation for complete installations. Flexible connectors on makeup water piping shall be installed as shown on the drawings.
- C. Cold water make-up lines shall be Type L hard temper copper tubing assembled with wrought copper solder end fittings.

## 2.4 NATURAL GAS PIPING

- A. Natural gas piping will be extended by the Plumbing Contractor and terminated at locations near the burners. The Heating Contractor shall properly connect to gas outlets, furnish and install lubricated gas cocks, and shall furnish and install gas line to each gas burner. A full line size gas cock shall be provided on gas line to each burner. Automatic controls for each burner, gas pressure regulator, and pilot line shall be installed to perform all function herein specified and to meet the requirements of Industrial Risk Insurers' (IRI). Gas vent piping shall be extended to the exterior of the Building in accordance with applicable codes and regulations. The gas vent piping vent shall be extended through the roof with a pipe portal.
- B. All gas piping shall be Schedule 40, black steel pipe, conforming to ASTM Specifications A53 and ANSI Standard B36.10. Gas piping 2-1/2" and larger shall be seamless and assembled with seamless forged steel welded fittings. Gas piping 2" and smaller shall be assembled with malleable iron screwed fittings. Galvanized pipe or fittings are not permitted. Gas piping shall be furnished and installed in strict accordance with the requirements of the local gas company.



## 2.5 JOINTS AND CONNECTIONS

### A. Screwed Connections:

1. All joints in screwed pipe shall be made up with pipe joint compound applied to male threads only. Taping of joints will not be permitted. Threads shall be cut straight and true with all sections reamed and cleaned before installation.
2. All black steel pipe 2" and smaller shall be assembled with heavy boss, cast iron or malleable screwed fittings.

### B. Welded Connections:

1. All joints in welded piping shall be assembled by fusion welding using factory-made welding fittings. Pipe shall be reamed and cleaned before erection. Weld-O-Lets or Thread-O-Lets may be used where the branch line is at least two (2) sizes smaller than the main line as hereinbefore specified.
2. All welding shall be done by competent welders in a first-class, workmanlike manner. No welding operator shall be permitted to weld unless he has proved satisfactory experience and/or certified as having fully complied with acceptable qualification tests. When a welder has been approved, he shall not be removed without permission of Architect.
3. Certification shall indicate that each welder has passed a qualification test as prescribed by National Certified Pipe Welding Bureau, or by other reputable testing laboratories or agencies, using procedures approved by the American Society of Mechanical Engineers or the American Welding Society.
4. The abutting ends of all pipe and welding fittings shall be accurately beveled at an angle of 45° to within 1/16" plus or minus 1/32" of inside pipe wall. All surfaces beveled by the cutting torch shall be properly cleaned of all oxide and unnecessary roughness by grinding, filing or other suitable means.
5. Low carbon steel welding rods shall develop a tensile strength of not less than 45,000 PSI cross-section of the metal deposited in the weld. Special and eutectic steel welding rods of good weldability and having a tensile strength greater than 45,000 psi may be used.
6. All circumferential welds shall have a width to 2-1/2 times pipe wall thickness and shall be reinforced approximately 1/16" above outside of pipe wall. Fusion shall extend through entire pipe wall to the outside. Projection of fused metal on inside of pipe must be avoided. There shall be no valley, either at edge or at center of the joint, and weld shall be built up with multiple passes so that weld metal will present a gradual increase in thickness from outside surface of pipe to the center of the weld.
7. Weld neck flanges shall be employed where welded pipe is joined to flanged valves and equipment.
8. Welding procedure shall conform to recommendations of the ANSI Code for Pressure Piping. Gas welding will be acceptable.

### C. Flanged Connections:

1. Flanged joints at valves, unions, equipment, etc., shall be made up with machine bolts and factory-made ring gaskets similar to Garlock, and of materials recommended for the various services. Flanges shall conform to ANSI B16.5.

### D. Solder Connections:

1. All joints in copper tubing shall be made up with 95-5 tin-antimony solder. Ends of pipe and fittings shall be cleaned and burnished before solder is applied.

E. Mechanical Crimping Connections:

1. For copper circulating water piping and cold water make-up piping of all sizes, the Viega ProPress System of mechanical joint copper tubing assembly shall be acceptable. The ProPress System shall consist of an electro-hydraulic pressure crimping tool, with sets of interchangeable crimping jaws, and ProPress special copper fittings. The fittings shall include an O-sealing ring, and shall require no torches, solders, flux, or special pipe burnishings or preparation. A permanent, watertight seal is made by crimping the fittings. Rated at 200 PSI; tested to 600 PSI. The systems shall be installed in accordance with manufacturer's installation instructions and governing code requirements. Pipe supports shall be installed so that interior horizontal piping is in uniform alignment.
2. The use of the ProPress System for tubing assembly is only acceptable when installed by tradespeople specifically trained in this type of assembly.

2.6 MECHANICAL GROOVED PIPE COUPLINGS

- A. The HVAC Contractor shall be permitted to furnish and install mechanical grooved pipe couplings in lieu of welded fittings and flanges on the following steel piping systems:
  1. Circulating Water Piping
- B. Acceptable Manufacturers:
  1. Victaulic (Basis of Design)
  2. Tyco Grinnell
  3. Anvil Golvok
- C. All grooved couplings, and fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
- D. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.
- E. Mechanical pipe couplings are not permitted in inaccessible spaces such as above plaster ceilings and piping and ductwork shafts unless approved by the Architect.
- F. Pipe shall be of type herein specified, except pipe shall be square-cut or roll grooved to the coupling manufacturer's specifications. The pipe couplings shall be as manufactured by the Victaulic Company of America, or approved equal, and shall be suitable for the type of service intended. Couplings and gaskets shall have a temperature range of -30 degrees F. to +230 degrees F. The couplings shall be installed in a manner which will provide for expansion and contraction of the systems without leakage, in strict accordance with the coupling manufacturer's details, published literature and instruction.
- G. Victaulic Installation-Ready Couplings Style 107H/107N (rigid) and 177 & 77 (flexible):

1. 2" through 12": Rigid type, coupling housings with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with ANSI B3.1, B31.9. Couplings shall be installation ready, for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM compound with red color code designed for operating temperatures from -30 deg F to +250 deg F. Victaulic Style 107H/107N.
  2. 2" through 8": Flexible type, for use in locations where vibration attenuation and stress relief are required. Couplings shall be installation ready, for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM compound with red color code designed for operating temperatures from -30 deg F to +250 deg F. Victaulic Style 177.
- H. Victaulic AGS Series Fittings, Style W07 Rigid Coupling, and Style W77 Flexible Coupling:
1. AGS grooved ends, for use with Victaulic W07 or W77 couplings and W741 flange adapter. Fittings shall be manufactured of ductile iron conforming to ASTM A-536, factory-fabricated from carbon steel pipe conforming to ASTM A-53. Fittings shall be manufactured to the dimensional standards ASME B16.9. Orange enamel coated or galvanized.
  2. AGS Couplings shall consist of two ASTM A-536 ductile iron housing segments, a wide-width elastomer pressure responsive FlushSeal® gasket, and zinc electroplated carbon steel track head bolts and nuts conforming to the physical and chemical requirements of ASTM A-449 and the physical requirements of ASTM A-183. Housings include lead-in chamfer on the housing key.
    - a. Victaulic W07 AGS Rigid Coupling: Coupling key shall be designed to fill the wedge shaped AGS groove to provide a rigid joint that corresponds with support spacings as defined by ASME B31.1 and B31.9. Systems incorporating rigid couplings require the calculated thermal growth/contraction of the piping system to be fully compensated for in the design of the piping system through use of adequate flexible components.
    - b. Victaulic W77 AGS Flexible Coupling: Coupling key shall be designed to fit into the wedge shaped AGS groove and allow for linear and angular movement, vibration attenuation, and stress relief
- I. Flange adapters shall be suitable for direct connection to Class 125 or 150 flanged components, with ductile iron housings, and pressure responsive gaskets. Victaulic Style 741 / W741.
- J. For use with copper tubing 2" and larger sizes, Victaulic Copper-Connection fittings conforming to ASME B16.22 and ASME B16.18, with Style 607H installation-ready coupling with offsetting angle-pattern bolt pads and grade EHP gasket for water service to +250 degrees F.
1. The system shall be manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.)
- K. Gasket Elastomers shall have properties designated by ASTM D-2000. Gasket shall be of the mechanical grooved coupling design, pressure responsive so that internal water pressure serves to increase the seal's water tightness. Gasket supplied shall be EPDM-HP Grade EHP with red and green color code for water service to 250 degrees F and EPDM Grade "E" with green color code identification and conform with ASTM D-2000 designation 2CA615 A25B442 with maximum tensile change as published by the manufacturer for water service to 230 degrees F.

- L. Bolts and nuts shall be heat-treated carbon steel conforming to physical properties of ASTM A183 and A449, minimum tensile 110,000 psi. The coupling segments shall be assembled with two or more oval neck track bolts. The nuts shall be tightened to assure firm metal-to-metal contact of the coupling bolt pads.
- M. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks. Gaskets shall be molded and produced by the coupling manufacturer and shall be verified as suitable for the intended service.
- N. The Contractor shall obtain the services of the coupling manufacturer's qualified representative as required to obtain all instructions and details for a complete supervised installation.
- O. The representative (direct employee) of the mechanical joint manufacture shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. The factory-trained representative shall periodically review the product installation and ensure best practices are being followed.
- P. Contractor shall remove and replace any improperly installed products.
- Q. A distributor's representative is not considered qualified to conduct the training.
- R. The Heating Contractor will be responsible for the installation complete in every detail.
- S. All insulation installations and other installation revisions will be the responsibility of the Heating Contractor. All mechanical pipe couplings shall be insulated with Zeston, Knauf, or approved equal, prefabricated fitting covers designed specifically for mechanical couplings. Valves, cocks, and other piping system accessories shall be revised as required to accommodate the coupling installation. The installation must conform with all applicable codes.
- T. Sufficient hangers must be installed as required for complete substantial installations.
- U. The entire installation shall be free of stress. For water systems, Victaulic flexible couplings may be used to accommodate thermal growth, contraction, and for the elimination of expansion loops. (In accordance with the manufacturer's written recommendations.) Where loops are required, use flexible couplings on the loop.
- V. Three Victaulic flexible couplings may be used in lieu of flexible connectors for vibration attenuation. The couplings shall be placed in close proximity to the source of the vibration.

## 2.7 REFRIGERATION PIPING

- A. Furnish and install a complete refrigeration piping system from the air-cooled condensing unit to the DX coil in all split system air conditioning units.
- B. All refrigeration piping and accessories shall be installed in accordance with the refrigeration equipment manufacturer's recommendations and in accordance with the best standard practice.
- C. System shall be complete with necessary shutoff valves, purge valves, charging valves, liquid line solenoid valve, sight glasses, dryers, vents, traps, fittings and other accessories required for a complete installation.

- D. System shall be fully charged with refrigerant in accordance with the manufacturer's recommendations and requirements.
- E. Refrigerant piping shall be sized as recommended by the equipment manufacturer and based on total friction loss equivalent to not more 2 degrees F for hot gas line, and 1 degree F for liquid line.
- F. Refrigeration piping shall be hard temper, or soft annealed, Type L, or ACR copper tubing assembled with long radius wrought copper solder end fittings or SAE fittings.
- G. The contractor shall properly clean the piping, eliminating all moisture and contaminants, which could harm refrigeration or air conditioning equipment, before charging with refrigerant.
- H. Refrigeration lines shall be properly supported.
- I. Refrigeration valves shall be back-seating globe valves of the diaphragm packless type, as manufactured by Alco, Superior or approved equivalent. Shutoff valves shall be furnished and installed on all lines at the condensing unit and at the air-handling unit.
- J. The Contractor shall include initial startup of the system, final checkout and instruction to the Owner's operating personnel.
- K. Maintenance service for the refrigerant piping system shall also be included in the Contractor's bid for the first year from date of final acceptance by the Owner.
- L. The approximate refrigerant piping arrangement, sizes, etc., are shown on the Drawings. The exact arrangement, sizes and other details shall be in strict accordance with the equipment manufacturer's diagrams, which shall be submitted for approval.
- M. Installation of refrigeration systems shall be by technicians certified to purchase and handle refrigerants. Technicians are required to pass an EPA-approved test given by an EPA-approved certifying organization to become certified.
- N. Apprentices are exempt from certification requirements provided the apprentice is closely and continually supervised by a certified technician.

## 2.8 CONDENSATE DRAIN SYSTEM

- A. All condensate drain piping from HVAC equipment not in return, relief or conditioned air plenum spaces shall be polyvinyl chloride (PVC) Schedule 40 plastic pipe (DWV) ASTM 2665. All condensate drain piping in return, relief, or conditioned air plenum spaces shall be Type "L", hard temper, copper tubing, assembled with cast bronze or wrought copper solder end drainage fittings. PVC fire rated insulated piping systems shall be acceptable, as herein specified.
- B. Direct connection to the sanitary drainage system is prohibited. Provide air gaps in accordance with local prevailing code requirements.
- C. Unless noted otherwise, drain lines shall be sloped at 1%. Minimum drain line size shall be 1-1/4", except as otherwise specifically noted.

- D. Provide a trap in gravity drain line at each piece of equipment. Coordinate depth of trap with equipment manufacturer. Refer to connection details shown on drawings. Traps will not be required on pumped condensate drain lines.
- E. No PVC or plastic piping shall be used in return, relief or conditioned air plenum spaces. Use metallic piping and tubing systems as specified. In lieu of metallic piping, tubing, and fittings, the Contractor may use standard PVC piping and fittings with the addition of flame – attenuated fiberglass pipe insulation and fittings or non-combustible ceramic fiber pipe wrap and fittings in these areas, conforming to local fire codes and building codes. Flame-attenuated fiberglass pipe insulation shall be as manufactured by Owens-Corning Company, or approved equivalent; fire retardant fittings by Zeston, Proto, Speedline, or approved equivalent. Ceramic fiber pipe wrap and fittings shall be 3M FireMaster ceramic fiber Plenum Wrap, or approved equivalent. All insulation installations shall be completed by an Insulation Subcontractor responsible to the HVAC Contractor.
- F. Joints in PVC pipe shall be accomplished with socket type fittings and solvent-cement welding for the DWV System.
- G. All joints shall be made permanently gas and water tight.
- H. The use of any of the above joints and connections shall be subject to their acceptability with the prevailing local plumbing codes.
- I. Where condensate drain lines are extended to rain conductors, use bronze ball check valves in the condensate drain lines, the Apollo 61-12X, with light spring, or approved equivalent.

### PART 3 – EXECUTION

#### 3.1 PIPING SYSTEM INSTALLATIONS

- A. All piping installations shall be in accordance with American Code for Pressure Piping No. ANSI B31.1. All piping not specifically mentioned herein shall be installed per the manufacturer's recommendations and applicable recognized codes.
- B. All piping and system accessories shall be stored with ends closed tight.
- C. Before installation, each length of pipe, each fitting and each accessory (such as a valve) shall be "bore-sighted", inspected and cleaned if debris or dirt is found.
- D. After installation of piping, but before valves and accessories are installed, a heavy wad of swabbing cloth shall be pulled through the piping and fittings. All loose scale or debris shall be blown or worked free and removed.
- E. After closure, each system shall be flushed clean as herein specified under "Cleaning." Connections shall be installed for this purpose, and all necessary temporary piping shall be furnished, installed and removed after system is approved. The Contractor shall double-check to see that items such as rocks, stones, mud, wood and other debris are not left in the system.

- F. Equipment such as tanks shall be cleaned in the same manner, but the procedure shall be varied to suit the specific item being cleaned. Coils shall be absolutely clean inside and outside before closure and after use for temporary heat, etc.
- G. All pipes shall be cut accurately to measurements established at the Building and shall be worked into place without springing or forcing, properly clearing all Building openings. Excessive cutting or other weakening of the Building structure to facilitate piping installation will not be permitted. Threaded pipe shall have full, clean-cut threads. All pipes shall have burrs removed by reaming. All pipes shall be so installed as to provide proper drainage and to permit free expansion and contraction without causing damage. All changes in directions shall be made with fittings.
- H. The ends of piping and associated equipment shall be capped or plugged as construction proceeds to prevent the entrance of dust, dirt, and other foreign matter.
- I. Valves shall be so placed that automatic valves, check valves and equipment may be entirely isolated for repairs while the system is in operation.
- J. All piping run within the Building shall be run concealed in the finished portions of the Building, in pipe spaces, furred ceilings or furred chases and exposed only in unfinished areas, Mechanical Rooms, or specifically where shown on the Drawings. The Heating Contractor shall locate all necessary chases or openings in new construction that are to be provided by the General Contractor. No piping shall be run exposed in finished areas of the Building without the consent and approval of the Architect for each specific installation.
- K. All piping shall be hydrostatically, or air tested to 150 PSIG, or 1.5 times the design pressure, whichever is higher, for a period of two (2) hours. During this period all welds, joints, etc., shall be coated with soap emulsion to test for leaks, which shall be made tight and free from imperfections. Piping joints shall not be insulated until they have been pressure tested and are free of leaks.
- L. All piping shall be cleaned, filled and vented of all air as herein specified.
- M. Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, valves or similar items which may be required to make a complete operating system. The Drawings are generally diagrammatic and indicative of the work to be installed. The Heating Contractor shall carefully investigate all conditions affecting his work and shall install his work in such a manner that interferences between pipes, conduit, ducts, equipment, architectural and structural features will be avoided, and shall furnish and install all such offsets or fittings as may be required to meet the conditions at the Building, so as to avoid such interferences without additional cost to the Owner.
- N. Each installation shall be made in a workmanlike manner, according to the best practice of the trade, properly installed and vented to eliminate air pockets or traps and to insure rapid and noiseless circulation throughout.
- O. All pipe work shall run parallel with, or at right angles to Building walls and partitions, and all exposed connections, risers or other piping in such areas shall be erected plumb and straight so as to form parallel lines with walls and floors. These requirements refer to long and short runs alike. Piping shall not be run exposed in finished areas unless specifically shown and prior approval is obtained from the Architect.

- P. Each section of pipe shall be reamed and cleaned before installation. All steel piping 2-1/2" and larger shall be assembled with welded connections. Seamless forged welding fittings of same material as pipe shall be used for all connections, except Weld-O-Lets or Thread-O-Lets may be used where branch line is at least two sizes smaller than main line.

END OF SECTION 232113



## SECTION 232123 – HVAC PUMPS AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The pumps for the various HVAC systems shall be as hereinafter described in this section.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

- A. Pumps shall be suitable for circulating water service which shall include the following systems:
  - 1. Hot Water Supply and Return (HWS & R)
- B. Furnish and install in strict accordance with the manufacturer's details and recommendations, new base mounted water circulating pumps, of cast iron, bronze fitted construction.
- C. Each motor shall be standard drip proof, high efficiency type, rubber-mounted. Motors shall be wound for current characteristics and operate at RPM as scheduled on the Drawings.
- D. Motor for each pump shall be sized so that pump is non-overloading on any point on the pump characteristic curve.
- E. The pumps shall be factory tested at operating conditions, thoroughly cleaned, and finished with machinery grade enamel paint.
- F. Each pump shall be furnished with one spare set of bearings and a spare coupling, which shall be delivered to the Owner.
- G. Verification of delivery, in writing, shall be obtained from the Owner, with a copy delivered to the Architect

#### 2.3 INLINE PUMPS

- A. Acceptable Manufacturers:
  - 1. Bell & Gossett Series e-90 (Basis of Design)
  - 2. Armstrong Pumps, Inc.

3. Taco
4. Patterson

- B. Furnish and install in-the-line, direct-connected centrifugal pumps. Pumps shall be quiet operating and shall have capacity and motor characteristics indicated on the Drawings.
- C. Pumps shall have 175 PSI WWP and shall be complete with cast iron housing, companion flanges, bronze trim, mechanical seal, center dropout coupler, lubricated bearings, bronze impeller and dynamically balanced shaft.

## 2.4 SUCTION DIFFUSERS

- A. Suction diffusers shall be installed at each end suction pump where piping arrangement so dictates as recommended by the pump manufacturer.
- B. Each unit shall consist of angle type body with inlet vanes and combination diffuser-strainer orifice plate with 3/16" diameter openings for pump protection.
- C. Unit shall be equipped with disposable fine mesh startup strainer, which shall be removed after 30 days of operation.
- D. Velocity through strainer free area shall not exceed 2 fps and pressure drop shall not exceed 1 psi at specified flow. Body shall fit pump and connecting pipe size.
- E. Unit shall be provided with adjustable support foot to carry weight of suction piping.
- F. Provide inlet pressure gauge and outlet compound gauge to indicate when cleaning is necessary.
- G. Suction diffuser shall be as manufactured by the pump manufacturer.
- H. Where mechanical pipe grooved couplings are used, the following suction diffuser shall be permitted:
  1. Suction Diffuser – Flanged outlet with grooved inlet connections, rated to 300 psi (2065 kPa). Ductile iron (ASTM A-536) body, 304 stainless steel frame and perforated sheet diffuser with 5/32" (4,0mm) diameter holes. Removable 20 mesh 304 stainless steel start-up pre-filter, outlets for pressure/temperature drain connections, and base support boss. Victaulic Series 731-G and W731-G.

## 2.5 TRIPLE DUTY VALVES

- A. Acceptable Manufacturers:
  1. Bell & Gossett (Basis of Design)
  2. Armstrong Pumps, Inc.
  3. Taco
  4. Patterson

- B. Furnish and install as shown on the plans, a triple duty valve designed to perform the functions of a non-slam check valve, throttling valve, shut-off valve, calibrated balancing valve and system flowmeter.
- C. The valve shall be of heavy-duty cast iron construction with standard 125 psig ANSI flanged connections, and rated for a maximum working pressure of 175 psig at 250 deg. F.
- D. The valve shall be fitted with an EPDM soft seat, replaceable bronze disc, stainless steel stem and chatter preventing spring.
- E. The valve design shall permit repacking under full system pressure.
- F. Each valve shall be equipped with brass readout valves (with integral check valve) for taking differential pressure readings across the orifice to accurately balance the system to specified design conditions.
- G. Check the operation of the valve and the pressure drop across the valve, and regulate the flow as required for the system.
- H. Read the pressure drop carefully and determine the system flow from the Manufacturer's pressure drop charts.
- I. Report the pressure drop and flow as required in Section 230593 - TESTING ADJUSTING AND BALANCING OF SYSTEMS.

## 2.6 FLEXIBLE CONNECTORS

- A. Provide a stainless steel braided type flexible connector in every pump suction and discharge, as close to the pump as possible to absorb vibration and prevent noise transmission.
- B. Flex connectors shall be as manufactured by Keflex, or Metraflex for the temperatures and working pressures of the systems being installed.
- C. Bellows style expansion joints are unacceptable and shall not be permitted as a substitute for stainless steel braided flexible connectors.
- D. Where mechanical pipe grooved couplings are used, the following shall be permitted:
  - 1. Three flexible type grooved joint couplings may be used in lieu of flexible connectors at equipment connections in applicable piping systems. The couplings shall be placed in close proximity to the vibration source. Basis of Design: Victaulic Company.
  - 2. Around Pump Applications Victaulic 380/381/382 Series Vibration Isolation Drops may be used.

## PART 3 – EXECUTION

### 3.1 PUMP INSTALLATION

- A. Install base mounted pumps on 4" high concrete housekeeping pad and grout base full. Balance per manufacturers recommendations.
- B. Base mounted pumps shall be leveled in accordance with the pump manufacturer's instructions.
- C. Pump and motor shaft alignment shall be made before and after grout is poured and again after final pipe connections are made.
- D. Mount and support inline pumps per manufacturer's recommendations.

### 3.2 TRIPLE DUTY VALVE INSTALLATION

- A. Install the triple duty valve as recommended by the Manufacturer. Provide access to remove the internal parts for service.

### 3.3 FLEXIBLE CONNECTOR INSTALLATION

- A. Mount the flex connectors in the suction and discharge piping as recommended by the manufacturer. Prevent any tension, torsion, or compression on the connectors from the pipe system.
- B. Tighten the connecting bolts with a torsion wrench as recommended by the manufacturer.
- C. Check the installation for leaks and remake any leaking joints.

END OF SECTION 232123

## SECTION 232510 - CLOSED LOOP WATER TREATMENT

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The contractor shall provide chemicals and labor for the pre-operational cleaning of all chilled, glycol or hot water loops and related equipment piping systems. This cleaning method is not intended for potable water systems. Contractor shall furnish and install all equipment, chemicals and service necessary for a complete water treatment program. A single water treatment company shall provide all products and services for undivided responsibility throughout the contract period. This company shall have an accredited laboratory. The water treatment products and services shall be provided by State Industrial Products or approved equal.

#### 1.3 ACCEPTABLE MANUFACTURERS

- A. State Industrial Products - Water treatment products and services (Basis of Design)
- B. Approved Equal

#### 1.4 SUBMITTALS

- A. The Contractor shall provide submittals for the following products required by this specification:
  - 1. Nitrite Test Kit
  - 2. Cleaning Solution
  - 3. Closed Loop Inhibitor

### PART 2 – PRODUCTS

#### 2.1 PRE-OPERATIONAL CLEANING

- A. Preparation for Clean-Out
  - 1. All systems must be prepared prior to the introduction of the chemical cleaner.
  - 2. Contractor shall flush all systems, including mud from drop legs. Remove, clean and replace all strainers. All systems shall contain the highest quality of water available.

3. Complete circulation must be achieved during the cleaning procedure. A minimum flow rate of 2 feet per second shall be maintained to ensure the cleaning chemicals will work properly. All electric, air, and thermostatic operated valves shall be open. All dead end runs shall be looped together with piping not less than 1/3 the size of the run. This piping is to remain in place until the cleaning is complete.
4. A minimum of 1 1/2" ball or gate valve is to be permanently installed in the low point of each system for the purpose of draining the system.

B. Cleaning Chemicals

1. A pre-operational cleaner shall be used to remove light grease, cutting oils, loose mill scale, organics and extraneous construction debris. The cleaner shall contain an organic phosphate, an organic corrosion inhibitor, a dispersant and an oil emulsifier, such as **Tempest**, or approved equal. Sufficient cleaner shall be used to treat all piping to remove oil and grease and to permit a uniform passivating film to form. This film aids in the prevention of flash corrosion when the system is most vulnerable to attack.

C. Pre-Operational Cleaning Procedure

1. Add recommended quantity of cleaning chemical directly into the closed loop before the recirculating pumps to ensure rapid mixing and distribution throughout the system. A small amount of antifoam may be added to prevent excessive foaming. Refer to MSDS for safety information.
2. Recirculate the system for 16-24 hours.
3. Open and drain mud legs and low points periodically during the cleaning process. Drain system completely paying particular attention to mud from drop legs and all low points.
4. Refill the system with clean potable water. Clean all strainers. Re-circulate for 8-12 hours and completely drain the system.
5. Refill the system. The length of time between the completion of the cleaning procedure and the addition of the corrosion inhibitor shall not exceed 24 hours.
6. Add the recommended level of closed loop inhibitor. The system is now ready for operation.
7. A service report shall be generated on-site by the water treatment representative certifying that the system has been cleaned in accordance with the above procedure and shall be copied to the mechanical contractor.

2.2 WATER TREATMENT PROGRAM

A. WATER TREATMENT CHEMICALS

1. Furnish a one (1) year supply of a liquid closed loop inhibitor for control of scale and corrosion in a closed recirculating system. Formulations shall not contain any ingredient which may be harmful to system materials of construction. The corrosion inhibitor shall contain a multi-functional blend of nitrite, molybdate, tolyltriazole, anionic polymer and buffering agents. Inhibitor shall be **HWS-135** or approved equal. A MSDS shall be provided for all chemical products. No system shall be operated without the benefits of chemical protection.

B. TEST EQUIPMENT

1. Furnish water test equipment, including storage case and spare reagents for maintaining control of the program standards in the closed loop system. Test kits shall include reagents and apparatus for the determination of nitrite level in the closed loop system.

C. WATER TREATMENT SERVICE PROGRAM

1. Provide start-up service and regular service visits to include:
  - a. Recommendations for installation and system start-up.
  - b. Initial treatment dosages.
  - c. Training of operating personnel on proper feed and control techniques.
  - d. Service visits and consultation meetings as required.
  - e. Provide necessary log sheets and record forms.
  - f. Provide laboratory and technical assistance as required.
  - g. All services shall be provided by a qualified full time representative of the approved chemical company.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install all equipment per manufacturers recommendation and Best Industry Standards.

END OF SECTION 232510

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## SECTION 233113 – DUCTWORK

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The ductwork for the various HVAC systems shall be as hereinafter described in this section.

#### 1.3 SUBMITTALS

- A. Submit shop drawings depicting dimensioned ductwork layouts.
- B. Submit duct construction standards for each ductwork pressure class required for this project.
- C. Shop drawings shall indicate assembly, duct dimensions, sheetmetal gauge or thickness, required clearances, construction details, and field connection details.
- D. Shop drawings shall define flange spacing dimensions and any additional reinforcement spacing dimensions.

#### 1.4 GENERAL REQUIREMENTS

- A. The Contractor shall furnish and install sheet metal work as required for proper operation of the heating, ventilating and air conditioning system, supply air, return air, and exhaust ventilating systems.
- B. The Contractor shall be held responsible to construct the air handling systems in accordance with UL requirements for the combinations on the Project.
- C. Ductwork shall include low and medium velocity heating and air conditioning supply, outdoor air, return, relief, transfer, and exhaust ventilation, mains, branches, access doors, dampers, wall sleeves, canvas connections, accessories, as hereinafter specified, and the necessary supports, bracing, stiffeners and hangers to provide neat vibration-proof air distribution systems.
- D. The Heating Contractor shall be responsible for notifying the General Contractor where ductwork or other equipment will be extended through the roof and exterior walls. It will be necessary to coordinate the exact location of structural members to provide clearance for the ductwork.
- E. The duct systems shall be arranged to maximize clearance for access to various dampers and other accessories.

- F. An access door shall be provided to service each damper.
- G. Attention is called to the limited space available for ductwork and close cooperation will be required between this Contractor and contractors for other trades.
- H. Sheet metal work shall be fabricated and installed in a neat and workmanlike manner and by persons experienced in this type of work.
- I. Furnish and install structural steel members for the support of the ductwork and equipment to suit the structural and vibration isolation conditions.

## PART 2 – PRODUCTS

### 2.1 LOW VELOCITY DUCTWORK

- A. Low velocity ductwork shall be constructed to SMACNA 2" WG pressure class standards.
- B. Low velocity ductwork shall consist of outdoor intake ducts, supply ducts, exhaust ducts, transfer ducts, relief air ducts, and return ducts.
- C. Low velocity ductwork shall be constructed and installed in strict accordance with the recommendations and details of SMACNA (Sheet Metal and Air Conditioning Contractors' National Association, Inc., 8224 Old Courthouse Road, Tysons Corner, Vienna, Virginia 22180), **except where these Specifications exceed SMACNA requirements.**
- D. Low velocity ductwork shall be neatly built, rigidly braced with structural shapes to prevent vibration.
- E. Ductwork shall be constructed of galvanized sheet steel conforming to ASTM A527 or aluminum conforming to Aluminum Association Standards Designation #3003-H14, except as otherwise specified.
- F. Miscellaneous transitions, shapes and accessories may not have been indicated on the drawings due to the scale, however, the Contractor shall install the necessary sheet metal accessories to complete the systems.
- G. Special care shall be exercised to provide tight fitting, well-fabricated well-braced ductwork systems.
- H. Adjustment mechanisms, controls and dampers of each kind must be accessible.
- I. Drive slip joints shall not be used for joint connections unless the Contractor thoroughly tapes each joint with 3M or approved equal 4" wide vinyl impregnated cloth duct tape with adhesive back. Two (2) 2" wide overlapped tapes may be used in lieu of 4" wide tape.
- J. Taped drive slip joints may be used on ducts up to and including 18" only.
- K. Rectangular low velocity ductwork and shall be constructed with the sheetmetal thickness, joints, and bracing as indicated in the following table:

Steel Gauge	Aluminum Thickness	Maximum Size, Inches	Type of Transverse Joint Connections	Bracing
24	.020"	Up to 12	Plain S Slip, Pocket Lock or Bar Slips on 8'-0" Centers	None
24	.025"	13 to 18	Plain S Slip, Pocket Lock or Bar Slips on 8'-0" Centers	None
24	.025"	19 to 30	Hemmed S Slip, 1" Pocket Lock or 1" Bar Slips on 10'-0" Centers	1" x 1" x 1/8" angles 5'-0" OC max.
22	.032"	31 to 42	1" Pocket Lock or 1" Bar Slips, on 5'-0" Centers	1" x 1" x 1/8" angles 5'-0" OC max.
22	.032"	43 to 54	1-1/2" Angle Connections or 1-1/2" Pocket or 1-1/2" Bar Slips on 5'-0" Max. Centers	1-1/2" x 1-1/2" x 1/8" angles 5'-0" OC max.
20	.040"	55 to 60	1-1/2" Angle Connections or 1-1/2" Pocket or 1-1/2" Bar Slips on 5'-0" Max. Centers with 1-3/8" x 1/8" Bar Reinforcing	1-1/2" x 1-1/2" x 1/8" angles 5'-0" OC max.
20	.040"	61 to 84	1-1/2" Angle Connections or 1-1/2" Bar Slips on 5'-0" Max. Centers with 1-3/8" x 1/8" Bar Reinforcing	1-1/2" x 1-1/2" x 1/8" angles 4'-0" OC max.
18	.051"	85 to 96	1-1/2" Angle Pocket Connections or 1-1/2" Angle Slips or 1-1/2" Bar Slips 5'-0" Max. Centers with 1-3/8" x 3/16" Bar Reinforcing	1-1/2" x 1-1/2" x 3/16" angles 3'-0" OC max.
18	.051	Over 96	2" Angle Pocket Connections or 2" Angle Slips 5'-0" Maximum Centers with 2" x 1/4" Bar Reinforcing	2" x 2" x 1/4" angles 2'-6" OC max.

- L. The thickness of low velocity rectangular ductwork shall be no less than 24-gauge.
- M. Exposed ductwork shall be one (1) gauge heavier than that listed in the table above or as indicated on the drawings.
- N. Round low velocity ductwork shall be fabricated of galvanized steel with lock-type spiral seams in accordance with SMACNA details and steel gauge thickness as listed in the SMACNA Manual, but not less than 26-gauge thickness. Round low velocity ductwork shall be as manufactured by United Sheet Metal, Semco, Hranec SMI, or approved equal.

- O. Round ductwork fittings shall be pressed or welded.
- P. Joints in ductwork shall be airtight and shall be constructed in accordance with SMACNA recommendations, except where SMACNA recommendations are exceeded by these Specifications.
- Q. Ductwork shall be supported by hanger straps, angles, rods, or bands, attached, sized and spaced in accordance with the SMACNA duct construction standards. Standard sheet metal practices listed and shown in the SMACNA "Duct Manual" shall apply to work to be performed.
- R. Longitudinal seam round ductwork will not be accepted.
- S. "Snap Lock" round ductwork will not be accepted.
- T. Adjustable elbows or fittings will not be accepted.

## 2.2 KITCHEN HOOD EXHAUST SYSTEM DUCTWORK - PREFABRICATED

- A. Furnish and install pre-fabricated kitchen hood exhaust system ductwork where specified on the drawings or contract documents.
- B. Acceptable Manufacturers:
  - 1. Metal-Fab Grease Duct Model No Chase™, Series 4G (Basis of Design) Local Representative - Pittsburgh Air Systems, Inc. 412-741-3070.
  - 2. AMPCO Grease Duct Model IVSI Zero Clearance, local representative – Deckman Company, 412-257-3333
  - 3. Metalbestos
  - 4. Heat-Fab
- C. The Grease Duct shall be factory prefabricated, double wall type, listed by UL for the venting of grease laden air from kitchen hoods requiring grease duct as described in NFPA 96. The Grease Duct shall be rated for continuous operation at 500° F (260° C) and intermittent operation at 2000° F (1093° C).
- D. The Grease Duct shall be listed and labeled UL/ULc 1978 "Standard for Grease Ducts – 0" Clearance", listed as "UL Classification: Grease Duct Assemblies Sub Category (HNOB) G-1, UL Fire Resistance Directory Alternate to 3 hr. Shaft Enclosure" and approved NMC: National Mechanical Code (BOCA) Research Report No. 96-37.
- E. The grease duct shall be listed and labeled as a fire rated system which can be installed at zero (0.0") inch clearance to combustible surfaces.
- F. The Grease Duct shall be listed to penetrate interior walls or partitions rated up to 2 hours. Products not rated by BOCA and listed by UL for zero clearance to combustibles and as a 2-hour fire stop will not be approved.
- G. The inner wall shall be constructed of Type 304 Stainless Steel. The outer wall shall be constructed of Aluminized Steel.

- H. The Grease Duct shall have a 4" wide annular space between the inner and outer walls, which is filled with 4" of high temperature ceramic fiber insulation.
- I. The Grease Duct shall be sealed liquid tight by means of a mechanical joint consisting of integral flanges on adjoining sections of pipe, held together with a stainless-steel flange band and sealed with Type P080 Sealant.
- J. The Grease Duct shall include hood and fan transitions, pipe supports and guides, fittings, cleanout ports, ports for the introduction of fire suppression or wash down nozzles, expansion joints and thimbles for penetration of non-fire rated building members, as shown on plans or as required to meet local building code requirements.
- K. Each component of the Grease Duct system shall be provided by the Grease duct manufacturer to ensure that the system meets the requirements of the listing.
- L. Grease Duct supports, or guides shall be anchored with FM Stainless Fasteners FIX Epoxy Anchoring System or equal, approved by the building code official.
- M. Anchors shall be a minimum of 5/8" diameter.
- N. Penetrations through partitions rated for up to 2 hours must be fire stopped in accordance with the manufacturer's instructions using the Model PICPPK fire stop kit.
- O. The Grease Duct shall be installed in complete compliance with the manufacturer's listed installation instructions.

## 2.3 DOUBLE WALL FLAT OVAL DUCTWORK

- A. Double Wall Flat Oval Ductwork shall be constructed to SMACNA 6" WG pressure class standards.
- B. Double-wall (insulated) duct shall be provided where specified on drawings or contract documents.
- C. Acceptable Manufacturers:
  - 1. McGill Airflow LLC - ACOUSTI-k27® (Basis of Design)
  - 2. Tambe Metal Products represented by Pittsburgh Air Systems.
  - 3. MKT Metal Manufacturing (York, PA).
- D. Unless otherwise indicated, insulated duct diameters shown on drawings are nominal inner liner dimensions.
- E. Insulated duct shall be constructed of a galvanized, perforated or solid (according to drawings) metal liner in accordance with the following:

Inner Liner Diameter (in.)*	Gauge	Construction
3 - 8½	28	Spiral

9 - 42	28	Ribbed Spiral
44 - 60	26	Ribbed Spiral
62 - 84	22	Spiral

\* For flat oval products, the diameter shown is the basic round diameter.

- F. When perforated metal liner is indicated, the acoustical performance shall equal or exceed that of McGill AirFlow. Perforations in the inner walls shall have an overall open area of 23 percent. A layer of fiberglass insulation of 2 in. thick and the outer pressure shell gauge shall always be based on outer shell dimensions.
- G. Insulated duct shall have a maximum thermal conductivity (k) of 0.27 Btu/hr/sq ft/deg. F/inch thickness at 75°F mean temperature.
- H. Insulation ends shall be provided at each location where internally insulated duct connects to single-wall duct or to any non-insulated component. The insulation end shall terminate the insulation and reduce the outer shell diameter to the nominal single-wall size.
- I. Double wall (insulated) fittings shall be provided where specified on drawings or contact documents.
- J. Insulated fittings shall be constructed of galvanized, solid metal liner in accordance with the following:

Inner Liner Diameter (in.)*	Gauge
3 - 34	24
35 - 58	22
60 - 84	20

\* For flat oval products, the diameter shown is the basic round diameter.

- K. A layer of fiberglass insulation of 2 in. thick and the outer pressure shell gauge shall always be based on outer shell dimensions. Insulated fittings shall have a maximum thermal conductivity (k) of 0.27 Btu/hr/sq ft/deg. F/inch thickness at 75 deg. F mean temperature.
- L. Double-wall round and flat oval connections shall be 3 - 36 in. diameter slip couplings with sealant and screws. Connections greater than 36 in. diameter shall be attached with an internal flange with sealant and joined with tec screws on 10-inch centers or tack welds. Mating flanges of T-25 connectors shall be joined at 6-8 inches on centers using #10 tec screws.

## 2.4 INSERTS

- A. The Contractor shall place hanger and support inserts in concrete. Special studs "shot" into concrete will not be permitted.

- B. Expansion shells shall be of the self-drilling types as manufactured by the Phillips Drill Company, Ramset, Rawlplug, or approved equal. Shells shall be the hammer installed, special flush or hanger rod types. Shells shall be installed with a drill-hammer.
- C. Lead expansion shields or lead wedge type shields are not permitted.
- D. Epoxy adhesive anchors, Hilti or equal, shall be used where specified on the design drawings.

### PART 3 - EXECUTION

#### 3.1 DUCTWORK TESTING

- A. The leakage shall not exceed the allotted amount for the pressure class, or the allotted amount for that portion of the system whichever is applicable.

Duct Class	2" WG
Seal Class	A
Sealing Applicable	Joints, Seams and Duct Wall Penetrations
<b>Leakage Class</b>	
Rectangular Metal	4
Round Metal	4

- B. Leakage tests are not required for the 2-inch WG duct pressure class.
- C. Concentrated leakage at any one point, on any duct, will not be permitted and shall be corrected to the satisfaction of the Engineer.
- D. Leak test procedures shall follow the outlines and classifications in the SMACNA *HVAC Duct Leakage Test Manual – Second Edition 2012*.
- E. Tests and necessary repairs shall be completed prior to concealment of ducts.

#### 3.2 INSTALLATION

- A. Install ductwork per SMACNA Standards.
- B. The ends of ductwork and associated equipment shall be capped plugged, or adequately sealed at fabrication, during shipping, during storage at the site and as construction proceeds to prevent the entrance of dust, dirt, and other foreign matter. Open ends on installed duct work shall be capped, plugged or adequately sealed to prevent the entrance of dust, dirt, and other foreign matter.

- C. Ductwork, regardless of function or pressure class, shall be sealed air tight from fan or unit connections up to and including the register, grille, or diffuser collar. Ductwork joints shall be sealed in their entirety.
- D. Shape and location of ducts may be changed to suit building conditions, but area must be maintained.
- E. Immediately notify the Engineer of changes to ductwork sizes from that indicated on the plans.

### 3.3 DUCT PENETRATIONS OF FLOORS AND WALLS

- A. Where vertical sheet metal ducts pass through floors or masonry construction, supporting angles shall be rigidly bolted to the floor.
- B. The horizontal leg of the angle shall be of sufficient width to provide adequate bearing surface for the support of the respective duct.
- C. In each case, the supporting angle shall be placed on four sides of the duct.
- D. Where ductwork is exposed (not enclosed in masonry), a 2" high concrete curb shall be completely formed around the sides of the floor opening to prevent water dripping to the ceiling below.
- E. Space between ductwork and wall or floor opening shall be filled with Dow Corning 3-6548 RTV sealant, or approved equal, to prevent the passage of flame and smoke.
- F. Where horizontal ducts pass through masonry wall construction, additionally provide sheet metal angles or flanges on each side of wall to completely close opening.
- G. Seal openings through walls of air plenum spaces and relief air shafts, where ducts, are installed under this Contract to assure airtight plenum spaces. Coordinate this work with contractors of other trades.

### 3.4 DUCTWORK INSTALLATION INSPECTION

- A. When ductwork serving a designated room, area, floor, or phase is completed, the Contractor shall notify the Architect, Engineer or Owner's representative to permit inspection of the ductwork and associated accessories prior to the installation of ceilings.
- B. The Contractor shall seal, repair, modify, or replace ductwork which is found during the inspection to not meet the requirements of the plans and specifications.
- C. If ceilings are installed prior to the ductwork inspection, the Contractor shall be responsible for subsequent repairs to general construction, and repairs, modifications, or replacements of ductwork made necessary by Testing, Adjusting, and Balancing results, significant leakage, or constrictions in the ductwork.

### 3.5 UNACCEPTABLE HANGER AND SUPPORT INSTALLATIONS



- A. It is unacceptable to support any pipe(s) or duct(s) from other pipe(s) or duct(s).
- B. It is unacceptable for this Contractor to support his work from the hangers of other trades. Each trade shall install its own hangers.
- C. Unacceptable hanger and support installations shall be corrected as directed by the Architect/Engineer at no cost to the Owner.
- D. It is unacceptable to attach supports to the building structure or concrete slabs using nails or a nail gun.
- E. Perforated steel strap and perforated steel angle are unacceptable supports for ductwork.

END OF SECTION 233113

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## SECTION 233300 - DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:

1. Backdraft dampers.
2. Manual-volume dampers.
3. Motor operated dampers.
4. Fire dampers.
5. Flexible ducts.
6. Turning vanes.
7. Access doors in ducts
8. Accessory hardware
9. Flexible connectors.

- B. Related Sections include the following:

1. Division 23 Section "Variable & Constant Volume Boxes" and "Fan powered VAV Terminal Units".
2. Division 23 Section "Air Outlets & Inlets."

#### 1.3 SUBMITTALS

- A. Provide product data for the following:

1. Backdraft dampers.
2. Manual-volume dampers.
3. Motor operated dampers.
4. Fire dampers.
5. Flexible ducts.
6. Turning vanes.
7. Access doors in ducts
8. Accessory hardware
9. Flexible connectors.

- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:

1. Special fittings and manual-volume-damper installations.
  2. Fire-damper installations, including sleeves and duct-mounted access doors and panels.
- C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

#### 1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with the following NFPA standards:
1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

#### 1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

### PART 2 - PRODUCTS

#### 2.1 BACKDRAFT DAMPERS

- A. Acceptable Manufacturers:
1. Arrow United Industries, Inc. (Type 655)
  2. Air Balance Inc. (Model BS 55)
  3. Greenheck Fan Corp. (Series VBD-360)
  4. National Controlled Air (Series BD2/A2)
  5. Ruskin Manufacturing Co. (Series CBD6)
  6. Nailor
  7. Pottorff
- B. Backdraft dampers shall be factory made of minimum .050" extruded aluminum blades supported on aluminum or zinc plated steel rods, in nylon bearings, set in minimum .063" extruded aluminum frame.
- C. Blades shall be fitted with vinyl inserts on contact edges to prevent noise. Blades shall be 40" maximum length and 6" maximum individual width.
- D. Damper assembly shall be provided with an adjustable counter-balance device.
- E. Channel frame shall be fitted to duct, vent or wall opening and edges sealed airtight. Inside dimensions of channel frame shall not be less than the daylight opening of the grille so that frame is not visible with grille in place.

- F. Exhaust fans equipped with backdraft dampers shall be furnished with dampers conforming to the requirements of this specification, and shall be furnished with dampers full size of connecting collar.
- G. Backdraft dampers shall be provided in exhaust duct discharges and at exhaust fans to keep tramp air from entering ductwork or rooms.
- H. Where shown on the drawings, provide motor operated dampers in lieu of backdraft dampers.

## 2.2 VOLUME CONTROL DAMPERS

- A. Acceptable Manufacturers:
  - a. Air Balance Inc. (Rectangular Model AC-2, Round Model AC-112)
  - b. Arrow United Industries Inc. (Model 1770)
  - c. Louvers and Dampers, Inc. (Rectangular Model VCD-400, Round Model CD-600)
  - d. National Controlled Air (Rectangular Model SCD-57, Round Model SCD-RD-88)
  - e. United McGill Corp. (Round Dampers, Model SRSVL)
  - f. Nailor
  - g. Pottorff
- B. The Contractor shall provide volume control dampers as indicated on the drawings.
- C. Rectangular control dampers shall be of the factory fabricated opposed blade, multi-louver type, controlled from a single point with an adjusting device.
- D. Install end bearings with a rubber gasket on the outside of ducts or frames to prevent air leakage around the damper shaft and for smooth operation.
- E. Dampers shall be mounted in heavy galvanized steel channel frames and shall have smooth acting linkage.
- F. Blades shall be not less than 18 gauge galvanized, die-formed steel. Adjusting devices shall have locking mechanisms and shall be accessible.
- G. Round volume control dampers shall be factory fabricated, single blade, center pivoted, constructed of galvanized sheet steel, controlled from a single point with an accessible adjusting device with locking mechanism.

## 2.3 MOTOR OPERATED DAMPERS

- A. Motor Operated Dampers – Refer to Section 230900.

## 2.4 FIRE DAMPERS

- A. Acceptable Manufacturers:
  - 1. Greenheck, Inc. (Model DFD-150-Type B, Model CRD, Model DFD-155 Type C/CO/CR).

2. National Controlled Air (Model DFD-B)
  3. Ruskin Mfg. Co. (Model D1BD2-B, Model CFD-5A, Model D1BD2 and D1BD23 Style CR/CO)
  4. Air Balance Model D19 Type B
  5. Prefco Model 5500 DE4/DE6
  6. Pottorff
  7. Nailor
- B. Provide fire dampers with fusible links, where required by NFPA, in each duct that extends through fire rated construction, and where indicated on the drawings.
- C. The construction of fire dampers shall match or exceed the SMACNA pressure class standard of the ducts in which they are installed.
- D. Fire dampers shall be rated for 1-1/2 hours or 3 hours as required by the fire rating of construction in which they are installed.
- E. Fire dampers must be UL listed and approved for each particular type of installation in accordance with UL and NFPA 90A requirements.
- F. Provide dampers and associated sheet metal construction in accordance with UL requirements for the particular combinations on the project and in accordance with SMACNA recommendations.
- G. Fire dampers shall be accessible, with suitable means provided for replacing fusible links. Access doors shall be provided in ductwork, walls or ceilings.
- H. Fire dampers shall be constructed and installed in accordance with applicable requirements of the State and the National Fire Protection Association NFPA 90A.
- I. Dampers shall be dynamically tested, rated and labeled in accordance with the latest edition of UL Standard 555.
- J. Dampers generally shall be of the roll form blade design and shall bear the Underwriters' label.
- K. Damper blades shall be fabricated of 21 gauge galvanized steel.
- L. Frames shall be one piece.
- M. Entire assembly shall be given a rustproof protective coating by the manufacturer.
- N. Stainless steel blades and accessories conforming with UL and NFPA requirements will be acceptable.
- O. Fusible links shall have temperature rating approximately 50 °F. above the maximum temperature that would normally be encountered with the system in operation or shutdown, but not less than 212 °F. unless specifically indicated otherwise.
- P. Fire dampers shall be suitable for installation in horizontal and vertical positions.

- Q. Where fire dampers are installed in conjunction with grilles and registers in walls, it will be necessary for the Contractor to resize grilles and wall openings to accommodate additional area of damper assemblies where blades are stacked.
- R. Fire dampers shall have a full opening equal to the duct size or of sizes noted.
- S. Blades, in the open position, shall be located and stacked out of the air stream to allow 100 percent free open area for air flow.
- T. Fire dampers installed in masonry walls or air shafts shall be installed and secured to structural steel angles and channels provided under this Contract.
- U. Damper sleeves shall be No. 10 gauge in 8" to 18" diameter and No. 12 gauge over 18" diameter.
- V. Damper assemblies shall be provided with access doors, fusible links, bronze spring-holding catches and oil-impregnated bronze bearings.
- W. Applicable portions of low velocity duct fire dampers shall be considered a part of this specification.
- X. Metal wall sleeves and steel angle frames shall be furnished and installed at dampers in accordance with the manufacturer's details and as required by Underwriters'. Conform to recommendations of SMACNA.

## 2.5 FLEXIBLE DUCTS

### A. General Requirements:

- 1. Flexible duct in this specification is defined as an air connector or a conduit transferring air between an air duct or plenum and an air terminal unit or an air inlet or outlet.
- 2. Flexible ducts shall be used where specifically indicated on the Drawings or where required to pass ducts around conflicting construction and for connection to air terminals.
- 3. Use of air connectors (flexible ducts) shall be kept to a minimum, but shall not exceed 14 feet, as required by NFPA 90A.
- 4. Flexible ducts, as detailed on the drawings, shall be used on straight runs only and individual lengths shall be a minimum of 5 feet and a maximum of 8 feet.
- 5. Ducts shall be suspended with band hangers and wire spaced as recommended by the duct manufacturer and to prevent sagging and kinking.
- 6. Flexible ducts shall be attached to ductwork and terminals with cinch-type nylon bands and duct tape.

### B. Standard Flexible Duct Construction: *(To be used for typical applications where sound attenuation is not critical.)*

- 1. Acceptable Manufacturers:
  - a. Flexmaster USA Type 5M (Basis of Design)
  - b. Thermaflex
  - c. Wiremold Co.

2. Construction: Trilaminate of aluminum foil, fiberglass and aluminized polyester, mechanically locked to the duct helix without the use of adhesives.
3. Use a mechanical lock to form a continuous secure air tight joint without the use of adhesive.
4. The internal working pressure rating shall be at least as follows with a bursting pressure of at least 2-1/2 times the working pressure.
  - a. Positive: 10 inches WG
  - b. Negative: 10" inches WG thru 12" dia., 5" WG 14" & 16" dia., 1" WG 18" & 20"
5. The duct shall be rated for a velocity of at least 5500 feet per minute.
6. Suitable for operating temperatures of at least 250 °F.
7. Factory insulate the flexible duct with flexible fiberglass insulation. The R value shall be at least 6.0 at a mean temperature of 75 °F.
8. Cover the insulation with a reinforced aluminum pigmented vapor barrier jacket having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E 96, Procedure A.
9. The ductwork shall be UL 181 or ETL listed, Class 1 Air Duct and comply with NFPA 90A and NFPA 90B.

## 2.6 TURNING VANES

### A. Acceptable Manufacturers:

1. Aero-Dyne Sound Control Company, High Efficiency Profile, HEP (Basis of Design).  
Contact: [www.aero-dyne.net](http://www.aero-dyne.net) PH: 800-522-2423

- B. Turning vanes shall be installed at each change in direction of square or rectangular, low and medium velocity supply air ductwork, particularly at mitered elbows where radius elbows are impractical, and shall be of sizes to suit ductwork.
- C. Turning vanes shall be installed in outdoor air intake, return or exhaust ducts only where specifically shown or noted on the drawings.
- D. Turning vanes shall be an engineered, true airfoil design with smoothly rounded entry nose and extended trailing edge for low-pressure drop, anti-dirt, and positive fastening.
- E. Generated sound power level shall not exceed 54 decibels in band 4 at 2,000 FPM-duct 24 x 24.
- F. Fabricate assemblies with the Aero-Dyne Side Rail support system. Install vanes on design centers of 2.4 inches across the full diagonal dimension of the elbow. Tabbed or slotted dimple fasteners are not acceptable.
- G. Submittals are required; proposed substitution shall include independent performance test data for pressure loss and generated sound power levels.

## 2.7 ACCESS DOORS IN DUCTS



- A. Furnish and install access doors and frames to permit inspection, operation and maintenance of devices concealed behind the sheetmetal work.
- B. Provide duct access doors of insulated double panel construction, not less than 20 gauge, galvanized steel.
- C. Where ducts are uninsulated or are not lined, insulation in access doors may be omitted.
- D. Provide access doors with sponge rubber gaskets around their entire perimeter.
- E. Hang access doors in ductwork in separate frames on heavy flat hinges. Provide "Ventlok No. 100" cast zinc latches.
- F. Where space conditions preclude the use of hinges, provide a minimum of 4 heavy window type latches.
- G. Provide duct access doors not smaller than 18" x 18". Provide ducts smaller than 18" in width with access doors two inches less in width than the width of the duct. Minimum dimension of one side to be 18".

## 2.8 ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.
- B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.
- C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.
- D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## 2.9 FLEXIBLE CONNECTORS

- A. Acceptable Manufacturers:
  - 1. Ventfab
  - 2. Durodyne
  - 3. Approved equal
- B. Connections between motor operated equipment and ductwork shall be made through fire resistant canvas throats.
- C. Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel.
- D. Flexible Connector Fabric: Glass fabric double coated with polychloroprene.

1. Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
2. Minimum Weight: 26 oz./sq. yd.
3. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible".
- B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.
- C. Provide test holes at fan inlet and outlet and elsewhere as indicated.
- D. Install fire dampers according to manufacturer's UL-approved written instructions.
  1. Install fusible links in fire dampers.
- E. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.
  1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
  2. Install access panels on side of duct where adequate clearance is available.
- F. Label access doors according to Division 23 Section "Mechanical Identification."

#### 3.2 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION 233300

## SECTION 233423 – FANS

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The fans for the various HVAC systems shall be as hereinafter described in this section.

### PART 2 - PRODUCTS

#### 2.1 POWER ROOF VENTILATORS - TYPE B

- A. Acceptable Manufacturers:
  - 1. Twin City Model BCRD (Basis of Design)
  - 2. Greenheck
  - 3. ACME
  - 4. Carnes
- B. Roof mounted exhaust fans shall be of the belt driven centrifugal type.
- C. PERFORMANCE - Fans shall be tested in accordance with AMCA 211 and AMCA 311 test codes for air moving devices and shall be guaranteed by the manufacturer to deliver rated published performance levels. Fans shall be licensed to bear the AMCA certified ratings seal for both sound and air. Models shall be CULUS 705 listed.
- D. CONSTRUCTION - BCRD fans housings shall be constructed of spun aluminum and shall offer finish durability and aesthetic appearance. Fan spinings shall have a rolled bead edge for rigidity. All units have a deep venturi inlet to prevent snow and rain entry into the building. The curb cap shall include pre-punched mounting holes for ease of installation. A conduit chase constructed of electrical metallic tubing shall be provided to the motor compartment. The curb base shall provide protection from weather. Lifting lugs shall be provided inside the motor compartment for ease of handling and installation. Fans shall bear a permanently attached nameplate displaying model and serial number of the unit for future identification.
- E. MOTOR AND DRIVE ASSEMBLY - Motor and drive assembly shall be mounted on vibration isolators to eliminate vibration and noise transmission into the ductwork. Motors and drives shall be mounted out of the exhaust airstream.
- F. WHEEL - Fan wheels shall be of the centrifugal backward inclined type, constructed of aluminum and containing a matching inlet venturi for optimum unit performance. Wheels shall be statically and dynamically balanced.

- G. SHAFT - Fan shafts shall be precision-ground and polished. Shafts shall have a first critical speed of at least 125% of the fan's maximum operating speed.
- H. BEARINGS - Bearings shall be of the one-piece, pillow block type with relubricable zerk fittings. Bearings shall be designed for air handling service with a minimum L-10 life in excess of 100,000 hours; L-50 500,000 hours at the maximum cataloged operating speed. Bearing mounting plate shall have self-aligning tabs for exact locating and alignment of bearings.
- I. DRIVE - Drive assembly shall be constructed of heavy-gauge galvanized steel. Drives shall be sized for a minimum of 150% of driven horsepower. Machined, cast iron motor sheaves shall be adjustable for final system balance.
- J. MOTOR - Motors shall be heavy-duty ball bearing type, closely matched to the fan load. All single-phase ODP motors shall contain thermal overload protection. All motors shall be UL and /or CSA recognized. Motor adjustment shall allow precise belt tensioning for optimum belt life and one-person adjustment and servicing.
- K. DISCONNECT SWITCH - A NEMA 1 disconnect switch shall be supplied with wiring leading from the motor to the junction box (ODP and TEFC motors).
- L. ACCESSORIES - When specified, accessories such as backdraft damper, roof curb, curb hinge, retaining chain, security hasp, NEMA-4 disconnect switch, 2-speed switch, firestat, aluminum bird screen, aluminum insect screen, and special coatings shall be provided to maintain one source responsibility.
- M. FACTORY RUN TEST - All fans prior to shipment shall be completely assembled and test run as a unit at operating speed or maximum RPM allowed for the particular construction type. Each wheel shall be statically and dynamically balanced in accordance with ANSI/AMCA 204-96 "Balance Quality and Vibration Levels for Fans" to Fan Application Category BV-3, Balance Quality Grade G6.3. Balance readings shall be taken by electronic type equipment in the axial, vertical, and horizontal directions on each of the bearings. Records shall be maintained, and a written copy shall be available upon request.
- N. GUARANTEE - The manufacturer shall guarantee the workmanship and materials for its roof and wall mounted centrifugal exhaust fans for at least one (1) year from startup or eighteen (18) months from shipment, whichever occurs first.

## 2.2 KITCHEN HOOD EXHAUST VENTILATOR - TYPE UB

- A. Acceptable Manufacturers:
  - 1. Greenheck Model CUBE (Basis of Design)
  - 2. Carnes Model VRBK
  - 3. ACME Model PNURG
  - 4. Twin City Model BCRU
- B. Furnish and install a roof mounted kitchen hood exhaust ventilator.
- C. Kitchen exhaust hood will be furnished and installed under the Food Service Contract.

- D. The installation of exhaust fan, exhaust ductwork, and accessories shall be coordinated with the Kitchen Hood Supplier and the Food Service Contractor.
- E. Exhaust duct shall conform to NFPA 96 requirements and shall be as hereinbefore specified.
- F. Kitchen hood exhaust ventilator shall be constructed and installed in accordance with NFPA 96.
- G. Ventilator housing shall be spun aluminum with centrifugal up-blast fan, belt driven, with extended base to place discharge 40" above roof.
- H. Fan wheel shall be dynamically, balanced, non-sparking, centrifugal, positively locked to drive shaft, non-overloading backwardly inclined blades, and lapped orifice design.
- I. Construction shall include a built-in grease drain. Finish on ventilator shall be unpainted mill-finished aluminum.
- J. Motor and drive shall be isolated from the airstream, and shall be located in a weatherproofed enclosure, equipped with breather tubes.
- K. The entire wheel and motor assembly shall be mounted on rubber vibration isolators. Variable pitch pulleys shall permit field adjustments.
- L. The unit shall be readily accessible for service and maintenance.
- M. The units shall be AMCA rated and shall bear their seal and shall be zone rated in accordance with AMCA Bulletin 301.
- N. Each unit shall be mounted on a factory built self-flashing acoustical roof curb furnished and installed by the Heating Contractor.
- O. Minimum height of the roof curb above roof shall be 12".
- P. Curb shall be constructed to conform to the roof slope.
- Q. Interior of curb shall be 16-gauge steel as required to conform with NFPA 96.
- R. Curb shall be Greenheck Model GPF or approved equal.
- S. Coordinate all work with the roofing subcontractor.
- T. Strip flashing, roofing cement and finished roofing will be furnished and installed by the roofing subcontractor.
- U. Fans shall be furnished with integral mounted and wired disconnect switch.
- V. Line side power connection shall be by the Electrical Contractor and load side connection shall be by the Heating Contractor.

## 2.3 CEILING MOUNTED DESTRATIFICATION FANS

- A. Acceptable Manufacturers:

1. Greenheck Model DS (Basis of Design)
  2. Big Ass Fans
  3. Approved Equal
- B. Ceiling mounted circulation or destratification fans shall be of the large diameter direct drive (high volume, low speed) type.
- C. Fan construction shall include a universal ceiling mount that is designed for fast and secure connection to a variety of ceiling substrates via heavy-duty mounting hardware kits (specified upon order).
- D. Universal ceiling mount shall be constructed of heavy gauge steel and shall include a bidirectional pivot to accommodate any ceiling angle.
- E. Fans shall also include a heavy gauge steel drop tube to provide a structural connection between the universal ceiling mount and fan motor.
- F. Drop tube shall be pre-wired for power input and plug-and-play control communications, and shall include a factory-mounted, wired, and programmed variable frequency drive.
- G. Drop tube shall also include a welded guy wire connection ring for fast and secure connection of the fan's guy wires.
- H. All components of the universal ceiling mount and drop tube shall be powder-coated for corrosion resistance and aesthetic appearance.
- I. Motors shall be of the high torque, low speed direct drive type, carefully matched to the fan load and furnished at the specified voltage and phase.
- J. Motors shall include plug-and-play connectors for power and control wiring to the variable frequency drive.
- K. Motors shall also be provided with a factory-installed hub that consists of heavy gauge, precision-cut aluminum plates and machined aluminum struts for ease of airfoil installation.
- L. Airfoils shall be constructed of 6005A-T6 extruded aluminum with a unique aerodynamic profile that has been optimized for maximum airflow and efficiency.
- M. Airfoils shall be provided with a clear anodized finish as standard, with additional finishes available in a variety of types and colors (specified upon order).
- N. Airfoils shall also be provided with precision-cut, powder-coated aluminum winglets as standard.
- O. Fan shall be provided with a multi-point, redundant safety system comprised of a heavy-duty safety retention cable, guy wire kit, hub retention system, and airfoil retaining links as standard.
- P. Fan shall bear a manufacturer's nameplate containing the model number and individual serial number for future identification.

### PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install per manufacturers recommendations.

END OF SECTION 233423

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## SECTION 233424 – ROOF MOUNTED EQUIPMENT ACCESSORIES

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The accessories for the various Roof Mounted HVAC systems shall be as hereinafter described in this section.

### PART 2 - PRODUCTS

#### 2.1 PREFABRICATED PIPE PORTALS

- A. Acceptable Manufacturers:
  - 1. RPS Accessories. (Basis of Design)
  - 2. Thycurb
  - 3. Pate Co.
- B. The HVAC Contractor shall furnish and install a prefabricated pipe portal system for all pipe lines extended through the roof. Bases, portal covers, counterflashing, and other accessories shall be furnished and installed by the HVAC Contractor. Openings in the roof will be by the General Contractor. Setting of curbs, flashing, counterflashing, etc. shall be by the HVAC Contractor.
- C. Curbs shall be 18 gauge galvanized steel of monolithic construction with integral base plate, continuous welded corner seams, factory-installed treated wood nailers, 1-1/2" thick 3 lb. density fiberglass insulation adhered to inside of all curb walls, and 18 gauge galvanized steel counterflashing. Curb heights and lengths shall be as required by the Contractor for installation of the lines shown. Top of curb shall be located not less than 12" above finished roof surface.
- D. The pipe portal for gas vent piping shall be furnished with a laminated acrylic coated ABS plastic curb cover with pre-punched mounted holes and molded sealing ring on an 8" collared opening, and an EPDM compression molded rubber cap and necessary stainless steel clamps. Curb covers shall be resistant to ozone and ultra violet sun rays and shall have a serviceable temperature range of -40 degrees F. to +160 degrees F. The molded sealing ring on the collared opening and the groove in the rubber cap shall be installed to assure a weathertight pressure and mechanical lock. The protective rubber caps shall have a serviceable temperature range of -60 degrees F. to +250 degrees F. and shall also be resistant to ozone and ultra violet sun rays. The conical shaped steps of the nipple shall provide a taut waterproof seal around the pipe. The stainless steel clamps shall provide added protection to guarantee the seal.

## 2.2 ROOF CURBS

### A. Acceptable Manufacturers:

1. RPS Accessories Model RC-A (Basis of Design)
2. Thycurb
3. Cambridgeport

### B. Furnish and install roof products and systems roof curbs at all roof openings as specified on the Drawings. Prefabricated roof curbs shall be of box section design, constructed using minimum 18 gauge galvanized steel, with fully mitered and welded corners, 3" cant. Roof curbs shall be internally reinforced on any side longer than 3'-0" and shall have factory internal base plate. Roof curbs to be insulated with 1-1/2" thick 3 lb. density fiberglass insulation, and factory installed wood nailers fastened from underside with TEK screws. Height to be 8" above the finished roof or as detailed. Roof curbs shall be level at the top with pitch built-in when deck slopes 1/4 of an inch per foot or greater, or as detailed.

### C. Prefabricated roof curbs shall be Model RC-A manufactured by Roof Products and Systems Corporation, Bensenville, IL, Thycurb or approved equivalent. Contractor fabricated roof curbs will not be accepted.

## 2.3 ROOFTOP EQUIPMENT SUPPORT SYSTEMS

### A. The following listed equipment roof support systems are specified to provide the Contractor with acceptable options. Each system is an acceptable option within the limitations of its intended design. The Contractor shall install the roof equipment support option(s) he selects per the manufacturer's instructions and in full coordination with the new and/or existing building roof and structure. The equipment support systems are permitted for use with, but not limited to, piping, ductwork, mini-split condensing units, VFR condensing units, solar panels, and step-over walkways.

### B. Equipment Rails

#### 1. Acceptable Manufacturers:

- a. RPS Accessories Model ER-A (Basis of Design)
- b. Thycurb
- c. Cambridgeport

#### 2. Equipment rails shall be manufactured of 18 or 14 gauge galvanized steel as required. Fully mitered and welded corners, 3" cant (except style ER-2A). Equipment rails shall be internally reinforced with integral base plate and factory installed wood nailer. (Specify 2 x 4, 6, 8, 10, 12). Height to be 8" above finished roof or as detailed. Equipment rails shall span a minimum of two (2) joists and not cantilever more than 6". Equipment rails shall be level at the top with pitch built-in when deck slopes 1/4" of an inch per foot or greater, or as detailed.

#### 3. Contractor fabricated equipment rails will not be accepted.

### C. Roof Top Piping and Duct Supports

#### 1. Acceptable Manufacturers:

- a. Roof Top Blox by Dymotek Corporation (Basis of Design)
    - b. C-Port Rooftop Support Solutions, <http://www.c-port.net>
    - c. Ecofoot
    - d. Miro Industries
  2. Piping, duct, and mechanical support blocks shall be constructed of a body molded from UV-resistant HDPE resin with a foam base platform of 1-inch thick, 25 LB density closed cell polystyrene.
  3. Block and height extension accessory shall have multiple piping saddles to organize piping and internal heavy-duty screw thread gripping feature.
  4. Block shall have provision to install  $\frac{3}{8}$ " or  $\frac{1}{2}$ " threaded rod with complete height adjustability from the top using engineered nut slots.
- D. Freestanding Non-Penetrative Support Systems
1. Acceptable Manufacturers:
    - a. Bigfoot Systems, [www.bigfootsupport.com](http://www.bigfootsupport.com) (Basis of Design)
    - b. C-Port/Clearline, <http://www.c-port.net/roof-walkways/>
    - c. Ecofoot
    - d. Miro Industries
  2. Components:
    - a. Plastic foot: Nylon, 30% glass fiber fill
    - b. Anti-vibration mat: SBR-Recycled Rubber
    - c. Metal framework: Hot dip galvanized steel
    - d. Concrete ballast feet: Reinforced concrete
    - e. Fix-It Foot: SBR-Recycled Rubber
  3. Permitted for:
    - a. Piping and ductwork step-over walkways and equipment access walkways.
    - b. Photo voltaic and thermal solar panels.
    - c. Piping, ductwork, mini-split condensing units, VFV and VRF units.
- E. **Pressure treated lumber for equipment support is unacceptable.**

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install per manufacturers recommendations.

END OF SECTION 233424

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## SECTION 233434 - AIR CURTAINS - EXPOSED

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Air curtains.

#### 1.2 REFERENCES

- A. AMCA 220 – Air Curtain Units.
- B. ARI 410 – Forced-Circulation Air-Cooling and Air-Heating Coils.
- C. NEMA 250 – Enclosures for Electrical Equipment.
- D. UL 507 – Electric Fans.

#### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's descriptive literature and installation instructions; indicate options specified.
- B. Shop Drawings: Submit if required to show configuration of non-standard units and additional installation instructions not shown in Product Data.
- C. Quality Assurance Submittals: Indicate compliance with QUALITY ASSURANCE.
- D. Closeout Submittals:
  - 1. Operation and Maintenance Data: Manufacturer's printed instructions for operating and maintaining air curtains.
  - 2. Warranty Documents: Issued and executed by manufacturer.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  - 1. Firm shall have produced products providing satisfactory use in similar service for not less than five (5) years.
  - 2. Products shall be manufactured and assembled in United States of America.
- B. Regulatory Requirements: Products shall comply with UL 507 and other applicable Underwriters Laboratory (UL) or Canadian Standards Association (CSA) requirements.

C. Certification:

1. Heated Units: Units shall be substantially similar to units tested in accordance with AMCA 220 and licensed to bear AMCA Certified Ratings Seal, except for inclusion of heating elements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store in manufacturer's unopened packaging in dry, heated area prior to installation.

1.6 WARRANTY

- A. Manufacturer's Warranty: Supply manufacturer's standard two-year limited warranty for heated units against defects in workmanship and materials.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Berner International Corporation, Architectural Recessed 12 and Architectural Low Profile (Basis of Design). Refer to the Schedule on the Drawings.

2.2 AIR CURTAINS

- A. Construction: Provide factory-assembled units of sufficient structural strength to be supported from ends without intermediate support.
- B. Cabinet
  1. Material and Finish: Anodized aluminum with custom finish. Color shall be as selected by the Architect.
  2. Fasteners: Tamper-resistant type.
- C. Motors: direct driven, 1600 rpm, three speed resilient mounted, continuous duty, with internal thermal-overload protection and sealed sleeve bearing permanently lubricated.
- D. Fans: Balanced forward curved type, double inlet, mounted in matched fan scrolls with aerodynamically formed air inlet venturies.
  1. Wheels and housings constructed of galvanized steel
- E. Discharge Nozzle:
  1. Provide uniform velocity across width of air door.
  2. Aperture: 2 1/2 in. slot by width of air door.

3. Vanes: 1-1/2 inches minimum height; constructed of airfoil-shaped aluminum extrusions; locking air-directional vanes adjustable plus or minus 20 degrees to deflect airflow.

F. Air Intake:

1. Location: Front.
2. Screen: Perforated aluminum with extruded aluminum frame.
3. Filter: provide re-cleanable filter for each intake screen.

2.3 HEATING ELEMENTS

A. Electric Heating Coil:

1. UL approved.
2. Factory-mounted, factory-wired, galvanized, steel frame, thermally protected.
3. Helical coil with point suspension of elements.
4. Thermal cutout: locks out electric heaters when prolonged abnormal over-temperature conditions exist.

2.4 CONTROLS

A. Switching:

1. Automatic Door Switch: Switch automatically activates unit when door opens and deactivates unit when door closes plunger type or roller arm as required for door interface.
2. Disconnect Switch
3. Remote Fan Speed Selector Switch.
4. Thermostat: Remote mount thermostat, with guard.

B. BMS Interface: Supply factory installed components to provide for BMS enable/disable of unit.

2.5 MOUNTING ACCESSORIES

- A. Provide brackets and other mounting accessories as required to permit installation and functioning of air door to meet project conditions of use.
- B. Mounting accessories shall be painted or galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that door frame and adjacent construction are installed and ready to receive work of this

Section.

- B. Verify that utilities are in correct location and are of correct capacities for specified products.

### 3.2 INSTALLATION

- A. Install air curtains where shown on Drawings and in accordance with shop drawings and manufacturers instructions.
- B. Air curtains shall be securely installed plumb, level, and as close as practical to top of opening and face of wall. Follow manufacturers instructions
- C. Install switches where indicated.
- D. Connection to utilities as required.

### 3.3 CLEANING

- A. Clean prior to commissioning.
- B. Repair or repaint damage to finishes on exposed-to-view surfaces.

### 3.4 SYSTEM STARTUP

- A. Test and operate air door to be sure that it performs as intended. Adjust discharge nozzles to deflect air outward [unless otherwise required].

END OF SECTION 233434



## SECTION 233600 – VARIABLE AND CONSTANT VOLUME BOXES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

### PART 2 - PRODUCTS

#### 2.1 VARIABLE AND CONSTANT VOLUME BOXES

- A. Furnish and install single duct (variable or constant volume) terminal units of the sizes shown in the plans, model LMHS as manufactured by Krueger, Titus, Trane, Carnes or approved equal.
- B. Terminals shall be certified by use of the ARI Standard 880-98 Certification Program and carry the ARI seal.
- C. Unit casing shall be constructed of not less than 22 gage, galvanized steel.
- D. All round air inlet collars shall accommodate standard flex duct sizes. Unit discharge shall be slip and drive construction for field attachment to downstream ductwork.
- E. Unit labels shall be adhered to each unit including model size, airflow (CFM), balancing chart, and tagged data.
- F. The control air damper assembly shall be constructed of heavy gage galvanized steel with solid 1/2" shaft rotating in Delrin® bearings. Damper shaft shall be marked on the end to indicate damper position. Damper blade shall incorporate a flexible gasket for tight airflow shutoff and operate over a full 90° rotation.
- G. Each unit shall be equipped with a factory installed, airflow sensing device. Provide a linear, multi-point, velocity-averaging sensor with an amplified signal.
- H. Provide balancing taps to allow for easy airflow verification.
- I. The radiated and discharge attenuation factors for the specified NC levels shall be based the attenuation factors from ARI Standard 885-98 Appendix E, which includes room absorption, environmental adjustment factor, duct insertion, end reflection and duct branching.
- J. 1" Thick Insulation: Unit casing shall be lined with 1" thick, 1 1/2 lb. dual density fiberglass insulation that meets UL 181 and NFPA 90A.

- K. **ELECTRIC HEATING COILS:** The terminal unit manufacturer shall supply electric coils that shall be ETL listed and designed to comply with UL Standard 1096. Construct coil casing with minimum of 20 gage galvanized steel. Elements shall be 80/20 Ni-Cr and supported by ceramic isolators. The integral control panel shall be housed in a NEMA 2 enclosure with access to all controls and safety devices.
- L. Electric coils shall contain a primary automatic and secondary manual reset thermal cutout and differential pressure airflow switch for proving of airflow.
- M. Line-a-Heat solid state electronic controlled electric heater with control of the leaving air temperature limiting the unit discharge temperature to a set value. Pulse-width modulation electric heat with mercury contactors is acceptable.
- N. The ATC Contractor will furnish the controller/damper actuator for factory mounting.
- O. The HVAC Contractor shall coordinate all terminal unit control requirements with the ATC Contractor.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install per manufacturers recommendations.
- B. The ATC Contractor will connect tubing from the airflow measuring device to the differential pressure sensor.
- C. The ATC Contractor will connect the terminal unit controller to the network communication bus.
- D. The ATC Contractor will furnish and install the unit transformer adjacent to a 120V junction box, which will be furnished and installed by the Electrical Contractor. The ATC Contractor will connect the 24V power from the unit transformer to the controllers of up to approximately five (5) terminal units.

#### 3.2 AUTOMATIC TEMPERATURE CONTROL INTERFACE

- A. VAV Boxes: Unit shall be furnished with no controls. Unit shall be equipped with a flow cross/ring averaging sensor that samples duct pressure and a control damper with a ½ in. extended shaft that requires rotary operation to open and close damper. The ATC Contractor shall furnish a DDC controller to the box manufacturer for factory installation by the box manufacturer for each variable/constant volume box. DDC controller to the airflow ring/cross furnished as part of the VAV/CV box. Box manufacturer shall also connect the DDC controller to the airflow ring/cross furnished as part of the VAV/CV box. Box manufacturer shall include the cost for all factory mounting and connecting work in the variable volume box pricing given to the heating contractor. The ATC Contractor shall furnish the reheat control valve for installation by the heating contractor.

END OF SECTION 233600

## SECTION 233713 - AIR OUTLETS AND INLETS

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

### PART 2 – PRODUCTS

#### 2.1 GRILLES AND REGISTERS – EXHAUST, RELIEF, TRANSFER AND RETURN AIR

- A. Acceptable Manufacturers:
  - 1. Krueger Model S480 (Basis of Design)
  - 2. Anemostat Model HP35H0
  - 3. Price
  - 4. Titus
- B. Furnish and install grilles and registers at exhaust or vent openings. The installation of grilles and registers shall be coordinated with work being done by contractors of other trades. Grilles and registers shall be located symmetrically at centers of ceiling tiles in acoustical tile ceilings. All grilles and registers shall be installed and located subject to the approval of the Architect.
- C. Ceiling mounted grilles and registers shall be suitable for installation in types of ceilings indicated on the architectural drawings.
- D. All grilles and registers shall be securely attached and supported from associated ductwork or, where not duct connected, shall be attached and supported from the building structural system. Grilles and registers shall not be supported on ceilings of any type.
- E. Grilles and register faces shall have a white factory painted finish and shall be provided with foam neoprene or rubber border gaskets.
- F. The return and transfer grilles in any wall areas shall be heavy-duty type with extra reinforcing bars. Heavy-duty grilles shall be Model S480 as manufactured by Krueger, or Model HD35HO as manufactured by Anemostat.
- G. Ceiling grilles shall be fabricated from aluminum and have fixed aluminum louvers, spaced 3/4" on centers and fixed at 35 degrees split deflection in ceilings and 35 degrees single deflection in sidewalls. Grilles shall be similar to Krueger Series S-580, with the style frame as required for the ceiling type.
- H. Faces of registers shall be as described for the grilles above. The damper shall be opposed blade with key-operated mechanisms or setscrew locking device to hold the damper blades in any set position. The dampers shall be fabricated from steel with prime coat finish.

- I. Factory painted finish shall be of color as selected by the Architect.

## 2.2 SUPPLY AIR REGISTERS

- A. Acceptable Manufacturers:
  - 1. Krueger Series 5880H (Basis of Design)
  - 2. Anemostat
  - 3. Price
  - 4. Titus
- B. Furnish and install in supply ductwork double deflection solid-bar adjustable vertical front louvers and solid-bar adjustable horizontal back louver grilles with frames. Supply registers shall be fabricated and finished as herein specified for exhaust grilles. Bars shall pass through supports as required to lock bars firmly in place.
- C. Supply registers shall have supply grille faces and be provided with key-operated worm gear mechanism or setscrew locked adjustable opposed-blade dampers. Supply air registers shall be located in a symmetrical manner subject to the approval of the Architect.
- D. Factory painted finish shall be of color as selected by the Architect.

## 2.3 PLAQUE STYLE DIFFUSERS – SUPPLY

- A. Acceptable Manufacturers:
  - 1. Krueger Model PLQ (Basis of Design)
  - 2. Anemostat
  - 3. Price
  - 4. Titus
- B. Provide Architectural square panel ceiling diffusers of the sizes and mounting types shown on the plans or outlet schedule. The diffuser shall have a one piece square face plaque not exceeding 18"x18" for 24"x24" panel sizes and 9"x9" for 12"x12" panel sizes and constructed of 16 gage steel with rounded corners that have a minimum radius of 3/4". Face plaques that have a secondary wrapper are not acceptable. The face plaque shall not extend below the ceiling more than 3/8" and shall be removable from the back-pan. Optional damper is not required. The diffuser back-pan shall be one piece stamped construction of 22 gage steel and have an integrally drawn round neck.
- C. Directional blow tabs shall be constructed of heavy gage steel and offered to provide 1-way, 2-way and 3-way throw patterns.
- D. The manufacturer shall provide published (printed or electronic) performance data for the diffuser. Performance data shall include 2 - 7 octave band sound power levels. The diffuser shall be tested in accordance to the data standards at the time of product introduction or ANSI/ASHRAE Standard 70.
- E. Diffusers shall include factory furnished insulation blanket.
- F. Factory painted finish shall be of color as selected by the Architect.

## 2.4 DUCT MOUNTED SUPPLY GRILLES

- A. Acceptable Manufacturers:
  - 1. Krueger Model 5DMGDU (Basis of Design)
  - 2. Anemostat
  - 3. Price
  - 4. Titus
- B. Grille shall be designed for installation directly on spiral duct, eliminating the need for register taps.
- C. Grille shall be furnished with double deflection blades and universal end caps to accommodate multiple duct diameters.
- D. Grille shall include extractor damper for volume control.
- E. Features shall include  $\frac{3}{4}$ " blade spacing and all aluminum construction.
- F. Finish shall be as selected by the Architect.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Installation per manufacturers recommendations.
- B. All diffusers, grilles, and registers shall be sealed at their neck connections to the ductwork.

END OF SECTION 233713

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## SECTION 235233 - WALL-HUNG STAINLESS STEEL HEATING BOILERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes wall-hung condensing gas-fired, stainless steel hydronic heating boilers

#### 1.2 REFERENCES

- A. ANSI Z21.13/CSA 4.9
- B. ASME, Section IV
- C. 2006 UMC, Section 1107.6
- D. ANSI/ASHRAE 15-1994, Section 8.13.6
- E. National Fuel Gas Code, ANSI Z223.1/NFPA 54
- F. AHRI
- G. NEC

#### 1.3 SUBMITTALS

- A. Product data sheet (including dimensions, rated capacities, shipping weights, accessories)
- B. Wiring diagram
- C. Warranty information
- D. Installation and operating instructions

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements
  - 1. ANSI Z21.13/CSA 4.9
  - 2. Local and national air quality regulations for low NOx boilers
- B. Certifications
  - 1. CSA
  - 2. ASME, Section IV, H Stamp and National Board Listed
  - 3. S.C.A.Q.M.D. Rule 1146.2 (<14 ng/J NOx emissions @ 3% O<sub>2</sub>)

4. CSA Low Lead Certified – less than .25% Lead

## 1.5 HEAT EXCHANGER WARRANTY

- A. Limited ten (10) year closed-system heat exchanger warranty
- B. Limited twenty (25) five-year thermal shock warranty

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Raypak, Inc.
  1. Contact: 2151 Eastman Ave., Oxnard, CA 93030; Telephone: (805) 278-5300; Fax: (800) 872-9725; Web site: www.raypak.com
  2. Product: XPak FT® wall-hung condensing stainless steel hydronic heating boiler(s)

### 2.2 BOILERS

- A. General
  1. The boiler(s) shall be fired with Natural gas at a rated input of 199 MBH.
  2. The boiler(s) shall be CSA tested and certified with a minimum AFUE rating of 94.8 percent at full fire for models 88AR-298AR, or minimum thermal efficiency of 96% for model 398A.
  3. The boiler(s) shall be ASME inspected and stamped and National Board registered for 80 PSIG maximum allowable working pressure and 192°F maximum allowable temperature, complete with a Manufacturer's Data Report.
  4. The wall-hung boiler(s) shall have a total weight of 275 lbs. or less.
- B. Primary Heat Exchanger
  1. The primary heat exchanger shall be of a multiple oval tube design and shall completely encircle the combustion chamber for maximum efficiency.
  2. There shall be no banding material in the header configuration. The heat exchanger is removable from the cabinet for replacement after removing the entire boiler assembly from the wall. The stainless steel combustion chamber shall be designed to have a condensate dish located on the bottom front and back section leading to the middle to ensure that condensation does not collect in the boiler.
  3. The low water volume primary heat exchanger shall carry a twenty (25) five-year warranty against thermal shock.
  4. The flue connection and combustion air opening shall be located on the top of the unit. The, gas connection, water connections, condensate drain, and electrical connections shall be located on the bottom of the unit.
- C. Condensate Drain



1. The boiler(s) will incorporate a condensate drain.

D. Burner

1. The combustion chamber shall be of the sealed combustion type employing a high temperature metal fiber burner, mounted in a vertical orientation.
2. The burner shall be a premix design and constructed of high grade stainless steel and must be capable of firing at both a complete blue flame with maximum gas and air input as well as firing infrared when gas and air are reduced. The burner must be capable of firing at 100% of rated input when supplied with 4.0" WC of inlet gas pressure, so as to maintain service under heavy demand conditions; no exceptions.
3. The burner shall use a combustion air blower to precisely control the fuel/air mixture for maximum efficiency throughout the entire range of modulation. The combustion air blower shall operate for a pre-purge period before burner ignition and a post-purge period after burner operation to clear the combustion chamber.
4. The blower shall infinitely vary its output in response to a PWM signal supplied directly from the Versa IC<sup>®</sup> modulating control, thereby electronically and precisely adjusting the volume of air and gas supplied for combustion. Minimum fire shall be 20 percent of rated input for models 88AR-278AR, and 10% for model 398A.

E. Ignition System

1. The boiler(s) shall be equipped with a 100 percent safety shutdown.
2. The ignition shall be spark ignition type with full flame rectification by the ignition source, with a three try-for-ignition sequence, to ensure consistent operation.
3. The igniter will be located alongside the burner to ensure easy ignition.
4. The Versa IC control module shall include an LCD display that indicates individual diagnostic faults.
5. A viewing port shall be provided, permitting visual observation of burner operation.

F. Gas Train

1. The boiler(s) shall have dual-seated main gas valve.
2. Gas control trains shall have a redundant safety shut-off feature, main gas regulation, and plugged pressure tapping to meet the requirements of ANSI Z21.13/CSA 4.9.

G. Boiler Control

1. The following safety controls shall be provided:
  - a. 195°F High limit control with manual reset (maximum system setpoint 190°F)
  - b. Flow switch, mounted and wired (optional on all models)
  - c. 50 PSIG ASME pressure relief valve, piped by the installer to an approved drain (shipped loose)
  - d. Temperature and pressure gauge (shipped loose)

2. The boiler(s) shall be equipped with an integrated PID modulating temperature controller with LCD display that incorporates an adjustable energy-saving pump control relay and freeze protection and is factory mounted and wired to improve system efficiency; three water sensors are included (system sensor is loose).
3. The boiler(s) shall allow for 0-10 VDC input connection for remote building DDC system control of system temperature or firing rate and have a built-in "Cascade" function to sequence and rotate while maintaining modulation of up to four boilers without utilizing an external sequencer.

H. Firing Mode: Provide electronic modulating control of the gas input to the boiler.

I. Boiler Diagnostics

1. Provide monitoring of all safeties, internal/external interlocks with fault display by a 3-1/2" LCD display:
  - a. System status
  - b. Ignition failure
  - c. Condensate blockage
  - d. Blower speed error
  - e. Low 24VAC
  - f. Manual reset high limit
  - g. Auto reset high limit
  - h. Low Water Cut Off (LWCO) (LWCO with test button standard on all sizes; LWCO with test & reset button standard on model 398A only)
  - i. Blocked vent
  - j. Low gas pressure switch (field-installed option)
  - k. High gas pressure switch (field-installed option on models 198AR-398A only.)
  - l. Flow switch fault (field-installed option)
  - m. Sensor failure
    1. Inlet sensor (open or short)
    2. Outlet sensor (open or short)
    3. System sensor (open or short)
    4. Air sensor (optional) (open or short)
    5. DHW sensor (optional) (open or short)
  - n. High vent temperature
  - o. Internal control fault
  - p. ID Card fault
  - q. Cascade communication error

J. Cabinet

1. The corrosion-resistant galvanized-steel jackets shall be finished with a baked-on epoxy powder coat, which is suitable for outdoor installation, applied prior to assembly for complete coverage.
2. The boiler(s), if located on a combustible wall, shall not require a separate combustible wall panel.
3. The boiler(s) shall connect both the combustion air and flue products through the top of the unit.

- K. Boiler Pump – An optional field-installed pump system shall be available.

## 2.3 BOILER OPERATING CONTROLS

- A. Each boiler shall have the ability to receive a 0 to 10 VDC signal from the Central Energy Management and Direct Digital Control System (EMCS) to vary the setpoint or control firing rate. Each boiler shall have an alarm contact for connection to the central EMCS system.
- B. Each boiler shall be equipped with Modbus communications compatibility with up to 146 points of data available.
- C. The boiler(s) shall feature the integrated Versa IC modulating digital controller with 3 user selectable modes, mounted and wired.
  - 1. Mode 1 = Hydronic, without indirect domestic hot water.
  - 2. Mode 2 = Hydronic, with indirect domestic hot water plumbed into system loop piping
  - 3. Mode 3 = Hydronic, with indirect domestic hot water plumbed into boiler loop plumbing
- D. System sensor and optional air temperature sensor shall be shipped loose for field installation by installing contractor. Inlet/Outlet sensors are factory-installed.
- E. Versa IC control system is capable of controlling up to 3 connected pumps.
  - 1. Boiler pump
  - 2. System pump
  - 3. Indirect DHW pump

## 2.4 DIRECT VENT

- A. The boiler(s) shall meet safety standards for direct vent equipment as noted by the 2006 Uniform Mechanical Code, section 1107.6, and ASHRAE 15-1994, section 8.13.6.
- B. The boiler shall be capable of supporting up to 100 ft of combustion air duct and up to 100 ft of effective vent length without reduction of vent size.

## 2.5 SOURCE QUALITY CONTROL

- A. The boiler(s) shall be completely assembled, wired, and fire-tested prior to shipment from the factory.
- B. The boiler(s) shall be furnished with the sales order, ASME Manufacturer's Data Report(s), inspection sheet, wiring diagram, rating plate and Installation and Operating Manual.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Must comply with:

1. Local, state, provincial, and national codes, laws, regulations and ordinances
2. National Fuel Gas Code, ANSI Z223.1/NFPA 54 – latest edition
3. National Electrical Code, ANSI/NFPA 70 – latest edition
4. Canada only: CAN/CSA B149 Installation Code and CSA C22.1 CEC Part I
5. Manufacturer's installation instructions, including required service clearances and venting guidelines

B. Manufacturer's representative to verify proper and complete installation.

3.2 START-UP

A. Shall be performed by Raypak factory-trained personnel.

B. Test during operation and adjust if necessary:

1. Safeties
2. Operating controls
3. Static and full load gas supply pressure
4. Gas manifold and blower suction pressure
5. Combustion analysis

C. Submit copy of start-up report to Architect and Engineer.

3.3 TRAINING

A. Provide factory-authorized service representative to train maintenance personnel on procedures and schedules related to start-up, shut-down, troubleshooting, servicing, and preventive maintenance.

B. Schedule training at least seven (7) days in advance.

END OF SECTION 235233

## SECTION 237300 – PACKAGED ROOFTOP UNITS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Packaged roof top units (15 to 25 tons) and components as scheduled and shown on drawings.
- B. Motor disconnects, motor starters, and variable frequency drives.

#### 1.2 RELATED SECTIONS

- A. The requirements of the General Conditions, Supplementary Conditions, Division 1, equipment schedules, and drawings apply.

#### 1.3 GENERAL

- A. Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing a fully hermetic, suction gas cooled, direct drive compressor(s) for cooling duty and gas combustion or nickel chromium elements for heating duty.
- B. Factory assembled, single- piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.
- C. Unit shall use environmentally sound, R-410A refrigerant.
- D. Unit shall be installed in accordance with the manufacturer's instructions.
- E. Unit must be selected and installed in compliance with local, state, and federal codes.

#### 1.4 QUALITY ASSURANCE

- A. Unit meets ASHRAE 90.1 minimum efficiency requirements.
- B. Unit shall be rated in accordance with AHRI Standards 210/240 or 340/360.
- C. Unit shall be designed to conform to ASHRAE 15, 2001.
- D. Unit shall be UL- tested and certified in accordance with ANSI Z21.47 -2012/CSA 2.3-2012, CSA C22.2 No. 236-11 (UL 1995) 4th edition and CSA C22.2 No. 3 - M 1988.
- E. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

- F. Unit casing shall be capable of withstanding 1000-hour salt spray exposure per ASTM B117 (scribed specimen).
- G. Unit shall be designed in accordance with ISO 9001, and shall be manufactured in a facility registered by ISO 9001.
- H. Roof curb shall be designed to conform to NRCA Standards.
- I. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory, and must be available upon request.
- J. Unit shall be designed in accordance with UL Standard 1995, including tested to withstand rain.
- K. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box
- L. Unit shall be tested to Truck 2, ASTM D4169 to ensure shipping reliability.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Unit shall be stored and handled per manufacturer's recommendations.
- B. Overhead crane can be used to place the units on a roof using rigging holes built into the unit base rails without any additions to the unit.
- C. Unit shall only be stored or positioned in the upright position.

#### 1.6 OPERATING CHARACTERISTICS

- A. Unit shall be capable of starting and running at 125°F (52°C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 340/360 at □□10% voltage.
- B. Compressor with standard controls shall be capable of operation down to 30°F (-1°C), ambient outdoor temperatures. Low ambient kit is necessary if mechanically cooling at ambient temperatures below 30°F (-1°C).
- C. Unit shall discharge supply air vertically or horizontally as shown on contract drawings.
- D. Unit shall be factory configured for vertical supply & return configurations.
- E. Unit shall be field convertible from vertical to horizontal airflow on all models.
- F. Unit shall be capable of mixed operation: vertical supply with horizontal return or horizontal supply with vertical return.

#### 1.7 ELECTRICAL REQUIREMENTS

- A. Main power supply voltage, phase, and frequency must match those scheduled on the drawings.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. JCI – Basis of Design
- B. Trane
- C. Carrier

### 2.2 EQUIPMENT SCHEDULES

- A. Rooftop unit schedule.
  - 1. Refer to the schedule on the drawings.

### 2.3 HVAC EQUIPMENT INSULATION

- A. Evaporator fan compartment:
  - 1. Interior cabinet surfaces shall be insulated with a minimum 1 in. thick, foil faced fiber glass insulation with thermal conductivity of 0.24 or better, adhered with acrylate polymer based adhesive.
  - 2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- B. Gas heat compartment:
  - 1. Interior cabinet surfaces shall be insulated with a minimum 1 in. thick, foil faced fiber glass insulation with thermal conductivity of 0.24 or better, adhered with acrylate polymer based adhesive.
  - 2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- C. Economizer and Control compartment:
  - 1. Interior cabinet surfaces shall be insulated with a minimum 1 in. thick, foil faced fiber glass insulation with thermal conductivity of 0.24 or better, adhered with acrylate polymer based adhesive.
  - 2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- D. Partition, Base Pan, and Duct Panel:

1. Interior cabinet surfaces shall be insulated with a minimum 1 in. thick, foil faced fiber glass insulation with thermal conductivity of 0.24 or better, adhered with acrylate polymer based adhesive.
2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

## 2.4 DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

### A. Simplicity SMART Equipment Control

1. Shall be ASHRAE 62- 2001 compliant.
2. Shall accept 20-30 VAC input power, 50/60Hz. 24 VAC nominal.
3. Shall have an operating temperature range from -40°F to 158°F; 10-90% RH (non-condensing UI), and -4°F to 158°F; 10-90% RH (non-condensing), with a storage temperature range from -40°F to 194°F; 5-95% RH (non-condensing).
4. Shall include an option of an Economizer microprocessor controller which communicates directly with the Unit Control Board and has 8 Analog outputs, 2 Analog inputs, 2 Binary outputs, 3 Binary outputs.
5. Controller shall accept the following inputs: space temperature, return air temperature sensor, set point adjustment, outdoor air temperature, indoor air quality, outdoor air quality, indoor relative humidity, compressor lock- out, fire/smoke shutdown, single and dual enthalpy, fan status, remote time clock, Sensor Actuator (SA) Bus communicated temperature/humidity/CO2 values from Network sensors, Field Controller (FC) Bus Network Overrides for space temperature, outdoor air temperature, space humidity, outdoor air quality, Indoor air quality, System purge.
6. Shall accept a CO<sub>2</sub> sensor or multiple CO<sub>2</sub> sensors networked together in the conditioned space, and be Demand Control Ventilation (DCV) ready.
7. Shall provide compressor short-cycle protection with minimum compressor runtime set at 3 minutes standard and adjustable from 2 to 7 minutes.
8. Built in lead-lag compressor sequencing to support balanced utilization of refrigerant circuits
9. Shall provide the following outputs: economizer, fan, cooling stage 1, cooling stage 2, heat stage 1, heat stage 2, heat stage 3/ exhaust/ reversing valve/ dehumidify/ occupied.
10. Unit shall provide surge protection for the controller through a circuit breaker.
11. Shall have open communication protocols with all required points exposed. Protocols supported include: BACnet®, MS/TP, Modbus®, and N2 communication.
12. Shall have an LCD display on the Unit Control Board to display fault messages as well as navigate the menu structure to review and change set points.
13. Shall utilize a USB connection to allow for uploading and downloading of data.
  - a. USB shall allow for downloading of “trending data” for analysis of inputs and values on other device such as a PC.
  - b. USB shall allow for uploading of new firmware to the UCB.
  - c. USB shall allow for backing up controller set points and parameters and for uploading of these same parameters to the UCB.
14. Shall include an RJ-12 port to be used with a Wi-Fi signal transmitting device and allow unit(s) access via any non-proprietary smart device.



- a. Unit access shall include ability to view and change all adjustable parameters and set points using the same characteristics and values available directly through the UCB joystick and LCD display.
  - b. Unit access shall be configurable at 3 different levels to allow control over parameter and set point changes.
  - c. Wi-Fi transmitting device can be connected by 3 means.
    - 1) RJ-12 port connected directly to UCB.
    - 2) Optional connection port mounted in operating space.
    - 3) Optional connection to building network allowing unit access from any internet browser worldwide.
15. Shall have the capability to control York Comfort Controls System (YCCS) zoning system
  16. Shall not require any proprietary software or contractor tool to start-up, commission and troubleshoot unit operation.
  17. Software upgrades will be accomplished by local download via USB port on main Unit Control Board.
  18. Shall be UL Recognized, File E107041, UL 916, Energy management Equipment, UL 1995, Heating and Cooling Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class B, CSA 22.2 No. 236, Signal Equipment Industry Canada, ICES-003 Recognized, and BTL certified.

## 2.5 PANEL AIR FILTERS

### A. Standard filter section.

1. Shall consist of factory installed, low velocity, disposable 2-in. thick fiberglass filters of commercially available sizes.
  - a. Filters shall be accessible through an access panel; hinged panel with “no-tool” removal option is available as described in the Features Options and Accessories section of this specification
  - b. Filters shall be 2” MERV 8 pleated

## 2.6 UNIT CABINET

- A. Unit cabinet shall be constructed of galvanized steel with exterior surfaces coated with a non-chalking, powder paint finish, certified at 1000 hour salt spray test per ASTM-B117 standards.
- B. Unit cabinet exterior paint shall be: film thickness, (dry) 3.0 MILS minimum, gloss (per ASTM D523, 60°F /16°C): 80+/-5, Hardness: H- 2H Pencil hardness.
- C. Unit cabinet shall have gas and electric utility knockouts in the side of the unit and in the unit underside. Base of unit shall have a minimum of four locations for through-the-base gas and electrical connections standard.
- D. Base Rail

1. Unit shall have base rails on a minimum of 4 sides.
  2. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
  3. Holes shall be provided in the base rail for moving the rooftop by fork truck.
  4. Base rail shall be a minimum of 15 gauge thickness.
- E. Condensate pan and connections:
1. Shall be an internally sloped condensate drain pan made of a non- corrosive material.
  2. Shall comply with ASHRAE Standard 62.
  3. Shall use a 1" NPT drain connection, possible either through the bottom or side of the drain pan. Connection shall be made per manufacturer's recommendations.
- F. Top panel:
1. Shall be a multi piece top panel.
- G. Gas Connections:
1. All gas piping connecting to unit gas valve shall enter the unit cabinet at a single location on side of unit.
  2. Through-the-base capability
    - a. Standard unit shall have a through- the- base gas- line location using a raised, embossed portion of the unit base-pan.
    - b. Optional, factory approved, water- tight connection method must be used for through-the-base gas connections.
    - c. No base-pan penetration, other than those authorized by the manufacturer, is permitted.
- H. Electrical Connections
1. All unit power wiring shall enter unit cabinet at a single, factory prepared, and knockout location.
  2. Through-the-base capability.
    - a. Standard unit shall have a through- the- base electrical location(s) using a raised, embossed portion of the unit base-pan.
    - b. Factory approved, water- tight connection method must be used for through-the-base electrical connections.
    - c. No base-pan penetration, other than those authorized by the manufacturer, is permitted.
- I. Units meet the seismic capacity requirements of the International Code Council Evaluation Service (ICC- ES) document AC156 (Acceptance Criteria for Seismic Qualification by Shake- Table Testing of Nonstructural Components and Systems), the International Building Code (IBC 2009), and the California Building Code (CBC 2010) with quality testing conducted in accordance with the standards of the American Society of Civil Engineers (ASCE 7-05).

1. Units are certified with an SDS (g) value of 2.0 using seismic design parameters of  $z/h=1.0$ ,  $I_p=1.5$  and certified by independent structural engineers.

## 2.7 GAS HEAT-FULLY MODULATING WITH SUPPLY AIR TEMPERING

- A. General – GAS HEAT MUST be able to fire and supply heat at all operating conditions. Gas heat for morning warm up only is NOT PERMITTED.

1. Heat exchanger shall be an induced draft design. Positive pressure heat exchanger designs shall not be allowed.
2. Shall incorporate a direct- spark ignition system and redundant main gas valve.
3. Gas supply pressure at the inlet to the rooftop unit gas valve must match that required by the manufacturer.
4. All units shall have two stages of heating capacity with equal capacity on each stage.

- B. The heat exchanger shall be controlled by an integrated gas controller (IGC) microprocessor.

1. IGC board shall notify users of fault using an LED (light- emitting diode).
2. The LED shall be visible without removing the control box access panel.
3. Unit Control Board shall contain algorithms that modify evaporator fan operation to prevent future cycling on high temperature limit switch.
4. Unit shall be equipped with anti-cycle protection with one cycle on unit flame rollout switch or 3 short cycles on the high temperature limit switch. Fault indication shall be made using an LED.

- C. Stainless Steel Heat Exchanger construction

1. Use energy saving, direct- spark ignition system.
2. Use a redundant main gas valve.
3. Burners shall be of the in- shot type constructed of aluminum- coated steel.
4. All gas piping shall enter the unit cabinet at a single location on side of unit (horizontal plane).
5. The optional stainless steel heat exchanger shall be of the tubular- section type, constructed of a minimum of 20- gauge type 409 stainless steel.
6. Type 409 stainless steel shall be used in heat exchanger tubes and vestibule plate.

- D. Induced draft combustion motor and blower

1. Shall be a direct- drive, single inlet, forward- curved centrifugal type.
2. Shall be made from steel with a corrosion- resistant finish.
3. Shall have permanently lubricated sealed bearings.
4. Shall have inherent thermal overload protection.
5. Shall have an automatic reset feature.

- E. Modulating Gas Heat - Unit heat shall be engineered to deliver variable heat to the supply air stream. The amount of heat available to the air stream shall be adjustable between the minimum turndown and the maximum capacity of the unit's heat. The modulating gas valve shall incorporate an outlet pressure slightly above atmospheric with the bypass closed and zero control voltage being applied. Minimum flow rate is adjusted by a manual adjustment screw on the side of the modulating valve. Controls shall be integrated into the main unit control board with a sub processor controlling modulating gas functions. An automatic safety shutoff valve is installed in series with the modulating gas valve for positive shut off in the no-heat mode of operation. In addition to all standard factory installed safeties the unit shall be equipped with the following additional safeties: Air proving flow switch, fan starter interlock, and an isolated modulating gas control power transformer.
- F. Modulating Gas Heat - Vent and Combustion Hoods - Any required hoods, stacks, and hardware are shipped inside the unit. Each hood or stack must be properly attached to the furnace doors to assure proper operation and compliance with any CSA/ETL certifications. Information in the IOM that ships with the unit will provide details on the hood and stack connections particular to this unit.
- G. Modulating Gas Heat - Gas Train Piping - Unit gas heat sub-system shall be piped to provide a fuel gas connection at a point within 2 inches of the base unit fuel gas connection point. Size of the connection shall remain unchanged from the base unit. An external regulator and shutoff valve must be provided by the installing contractor. The gas connections must be made in accordance with all state and local codes. No gas train specialty not specifically identified in the standard factory literature for the base unit or in this addendum is provided.
- H. Modulating Gas Heat – Controls – Discharge Air Temperature Control - The unit shall deliver discharge air at the setpoint determined by adjusting a potentiometer in the unit control panel, an LCD display, or communicated to the unit over the building automation system network, depending upon which options have been selected. Refer to the sequence of operation in this document for further details.
- I. Modulating Gas Heat – Controls – Supply Air Tempering - The unit shall deliver tempered supply air at the supply air tempering setpoint determined by adjusting a potentiometer in the unit control panel or over a network variable, depending upon selected options. The minimum turndown capability of the modulating gas heat may cause discharge air temperatures above the supply air tempering setpoint. Refer to the sequence of operation in this document for further details.
- J. Network Compatible Controls (BACnet, Lon, N2, Modbus) - The unit controls shall be equipped with a communications interface to provide network access over the selected network
- K. Modulating Gas Heat
  - 1. Mode Initiation – This mode is entered upon a heat one call being present at the unitary controller.

2. Gas Heat Staging – Upon entering a heating mode, the unit shall index the modulating stage of gas heat to full fire and begin the ignition sequence. After 90 seconds, control of discharge air temperature to discharge air temperature setpoint shall be initiated. Setpoint is adjusted by adjusting the heat supply air temperature setpoint on a potentiometer installed in the unit control panel, an LCD display, or communicated to the unit over the building automation system network, depending upon which options have been selected. The setpoint is adjustable between 60°F and 110°F.
3. After the 90 second ignition sequence the modulating stage of heat shall ramp from minimum fire to full fire. If additional heat is required the modulating stage shall be reset to minimum fire and the second stage of heat enabled if present. As the heat demand continues to increase the modulating stage shall be ramped towards full fire. Additional stages of heat behave in a similar fashion.
4. Safety Interlocks –A fan proving switch and a supply fan VFD or motor starter auxiliary switch must be made prior to enabling gas heat functions. Additional high limit temperature switches are installed in the burner cabinet for safety. These additional high limit safety switches are non-adjustable limit switches. The automatic reset limit switches trip at 180°F and the manual reset limit switches trip at 200°F.
5. Supply Air Temperature Reset – If a call for stage two heat is present at the unitary controller, the discharge air setpoint shall be indexed upwards by 20°F.

L. Supply Air Tempering

1. Mode Initiation – This mode is entered when mixed air temperature is below the supply air tempering setpoint and no compressors are enabled. Supply air tempering setpoint is changed by adjusting a potentiometer installed in the unit control panel, an LCD display, or communicated to the unit over the building automation system network, depending upon which options have been selected.
2. Modulating Gas Heat – Modulating gas heat is enabled and operates to maintain the discharge air temperature at the discharge air temperature setpoint. Minimum turndown capability of the modulating gas heat may cause discharge air temperatures above the supply air tempering setpoint. Supply air tempering shall turn off when supply air temperature rises above supply air tempering setpoint plus deadband.

M. Safety Interlocks – Compressor operation is disabled when in this mode of operation.

2.8 COILS

A. Standard Aluminum Fin - Copper Tube Coils:

1. Standard evaporator coils shall have aluminum plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
2. Shall be leak tested to 150 psig, pressure tested to 250 psig, and qualified to CSA C22.2 No. 236-11(UL 1995) 4<sup>th</sup> edition burst test at 1775 psig.
3. Assembled unit shall be pressure tested to 450 psig.

B. Standard All Aluminum Microchannel Coils:

1. Standard condenser coils shall have all aluminum microchannel design consisting of aluminum multiport flat tube design and aluminum fin. Coils shall be a furnace brazed design and contain epoxy lined shrink wrap on all aluminum to copper connections.
2. Condenser coils on all Heat Pump and Hot Gas Reheat units shall be Standard Aluminum Fin – Copper Tube coils as defined above.
3. Microchannel condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 bursttest at 1980 psig.
4. Assembled unit shall be pressure tested to 450 psig.

## 2.9 REFRIGERANT CIRCUITS

- A. High Efficiency AC units shall utilize FOUR (4) INDEPENDANT REFRIGERATION CIRCUITS- Anything less than four will not be accepted – no exceptions.
- B. Refrigerant circuit shall include the following control, safety, and maintenance features:
  1. Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb without removing the valve body.
  2. The lead circuit shall be furnished with hot gas by-pass for unloading.
  3. Refrigerant filter drier - Solid core design.
  4. Service gauge connections on suction and discharge lines.
- C. Compressors
  1. Unit shall use fully hermetic scroll compressors for each independent refrigeration circuit.
  2. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
  3. Compressors shall be internally protected from high discharge temperature conditions.
  4. Compressors shall be protected from an over- temperature and over- amperage conditions by an internal, motor overload device.
  5. Compressor shall be factory mounted on rubber grommets.
  6. Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.
  7. Crankcase heaters shall be installed in the factory for all necessary applications.

## 2.10 FILTERS SECTION

- A. Filters access is specified in the unit cabinet section of this specification.

## 2.11 EVAPORATOR FAN AND MOTOR

- A. Evaporator fan motor:
  1. Shall have permanently lubricated ball-bearings.
  2. Shall have inherent automatic- reset thermal overload protection.

3. The job site selected brake horsepower shall be required to not exceed the motor's nameplate horsepower rating plus the service factor.

B. Evaporator Fan:

1. Fan shall be a belt drive assembly with an adjustable pitch motor pulley.
2. Shall use sealed, permanently lubricated ball-bearing type.
3. Blower fan shall be double- inlet type with forward- curved blades.
4. Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.

2.12 CONDENSER FANS AND MOTORS

A. Condenser fan motors:

1. Shall be a totally enclosed motor.
2. Shall use permanently lubricated ball-bearings.
3. Shall have inherent thermal overload protection with an automatic reset feature.
4. Shall use a shaft- down design.

B. Condenser Fans:

1. Shall be a direct- driven propeller type fan.
2. Shall have aluminum blades riveted to corrosion- resistant steel spider brackets and be dynamically balanced.

2.13 VARIABLE FREQUENCY DRIVE (VFD)

- A. Shall be installed inside the unit cabinet, mounted, wired and tested.
- B. Shall contain Electromagnetic Interference (EMI) frequency protection.
- C. Insulated Gate Bi- Polar Transistors (IGBT) used to produce the output pulse width modulated (PWM) waveform.
- D. Built in LED display and controls. Does not require additional kit or options.
- E. RS485 capability standard.
- F. Electronic thermal overload protection.
- G. 5% swinging chokes for harmonic reduction and improved power factor.
- H. All printed circuit boards shall be conformal coated.

2.14 STANDARD INTEGRATED ECONOMIZER

- A. Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.
- B. Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory installed option.
- C. Damper blades shall be galvanized steel with metal gears. Plastic or composite blades on intake or return shall not be acceptable.
- D. Damper blades shall be class 1A dampers.
- E. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below set points.
- F. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
- G. Economizer shall comply with, and be certified to, the AMCA 511 standard.
- H. Standard leak rate shall be equipped with dampers not to exceed 3 cfm/ft<sup>2</sup> leakage at 1 in. wg pressure differential.
- I. Economizer controller shall be the Johnson Controls SE Economizer Controller
  - 1. On- board Fault Detection and Diagnostics (FDD) that senses and alerts when the economizer is not operating properly, meets the requirements for California Title 24, IECC 2015, and ASHRAE 90.1.
  - 2. Display alarms if the following occur
    - a. Economizer is economizing when conditions do not support
    - b. Economizer is not economizing when conditions do support
    - c. Damper Stuck
    - d. Excess Outdoor Air
    - e. Failed Sensor
  - 3. Automatic sensor detection
  - 4. Capabilities for use with multiple- speed indoor fan systems
  - 5. Utilize digital sensors: Dry bulb and Enthalpy
  - 6. UL, CSA, and ICES-003 recognized and FCC compliant to CFR47
- J. Shall be capable of introducing up to 100% outdoor air.
- K. Shall be equipped with power exhaust capable of relieving up to 100% return air and contain seals that meet ASHRAE 90.1 requirements.
- L. Shall be designed to close damper(s) during loss- of- power situations with spring return built into motor.



- M. Dry bulb outdoor air temperature sensor shall be provided as standard. Enthalpy sensor is also available on factory installed only. Outdoor air sensor set point shall be adjustable and shall range from 40° to 80°F / 4° to 27°C. Additional sensor options shall be available as accessories.
- N. The economizer controller shall also provide control of an accessory power exhaust unit function. Factoryset at 100%, with a range of 0% to 100%.
- O. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.
- P. Dampers shall be completely closed when the unit is in the unoccupied mode.
- Q. Economizer controller shall accept a 2- 10 Vdc CO<sub>2</sub> sensor input for IAQ/DCV control. In this mode, dampers shall modulate the outdoor air damper to provide ventilation based on the sensor input.
- R. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.
- S. Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.

#### 2.15 PROPELLER POWER EXHAUST

- A. Power exhaust shall be used in conjunction with an integrated economizer.
- B. Horizontal power exhaust shall be mounted in return ductwork.
- C. Power exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0- 100% adjustable set point on the economizer control.

#### 2.16 PHASE MONITOR

- A. Shall provide protection against phase reversal, phase loss, and phase unbalance.
- B. Switch shall automatically shut off unit control circuit if any of the above conditions is detected.
- C. Shall have visual LED indication of operational status.

#### 2.17 HINGED AND TOOL LESS ACCESS PANELS (FACTORY INSTALLED

- A. Cabinet panels shall be hinged
- B. Shall provide easy access with molded composite handles that are permanently attached and recessed into the panel.
- C. Shall be on major panels of: filter, control box, fan motor, and compressor.

2.18 DUAL POINT POWER

- A. The unit shall be equipped with dual point power. Compressors, condenser fans, and electric heat (if equipped) shall be connected to one circuit, labeled "Commercial Power". Supply fan, exhaust fan(s) (if equipped), control power and gas or hydronic heat (if equipped) shall be connected to a second circuit, labeled "Emergency Power".
  - 1. Non-Fused Disconnect Switch – Flange and finger style non-fused safety disconnect switch for both electrical circuits provided and installed. The base unit must be ordered with a factory provided disconnect switch. The disconnect switches will be sized per NEC standards and installed in a convenient location on the unit.
  - 2. Unit shall have and carry ETL/UL listing. Modified unit in the field are not permitted-
    - a. Dual point power must come factory provided and tested by the unit manufacturer. 3<sup>rd</sup> party modifications are not permissible.

2.19 CONVENIENCE OUTLET

- A. Powered convenience outlet.
  - 1. Outlet shall be powered from main line power to the rooftop unit.
  - 2. Outlet shall be factory installed and internally mounted with easily accessible 115- v female receptacle.
  - 3. Outlet shall include 15 amp GFI receptacles with independent fuse protection.
  - 4. Voltage required to operate convenience outlet shall be provided by a factory installed step- downtransformer.
  - 5. Outlet shall be accessible from outside the unit.

2.20 ROOF CURBS (VERTICAL)

- A. Where indicated on the drawings provide sound attenuating curb in lieu of RTU Manufacturer's curb. Refer to the RTU schedule.
- B. Full perimeter roof curb with exhaust capability providing separate air streams for energy recovery from the exhaust air without supply air contamination.
- C. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
- D. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.

2.21 SINGLE ENTHALPY SENSOR KIT

- A. The single enthalpy sensor kit shall provide a relative humidity sensor to be mounted in the outdoor air stream to provide single enthalpy economizer control
- B. The sensor allows the unit to determine if outside air is suitable for free cooling.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install equipment per industry standards, applicable codes, and manufacturer's instructions.
- B. Do not use RTUs for temporary heating, cooling or ventilation prior to complete inspection and startup performed per this specification.
- C. Install RTUs on roof curb, as shown on drawings.
- D. Install RTUs with manufacturer's recommended clearances for access, coil pull, and fan removal.
- E. Provide one complete set of filters for testing, balancing, and commissioning. Provide second complete set of filters at time of transfer to owner.
- F. Install RTU plumb and level. Connect piping and ductwork according to manufacturer's instructions.
- G. Install supports and anchors per applicable local building codes.
- H. Insulate plumbing associated with drain pan drains and connections.
- I. Install insulation on all staggered coil piping connections, both internal and external to the unit.

### 3.2 FIELD QUALITY CONTROL

- A. Store per RTU manufacturer's written recommendations. Store RTUs indoors in a warm, clean, dry place where units will be protected from weather, construction traffic, dirt, dust, water and moisture. If units will be stored for more than 6 months, follow manufacturer's instruction for long-term storage.
- B. Rig and lift units according manufacturer's instructions.

### 3.3 RTU INSPECTION

- A. Hire manufacturer's factory-trained and factory-employed service technician to perform an inspection of unit and installation prior to startup. Technician shall inspect and verify the following as a minimum:
  - 1. Damage of any kind
  - 2. Level installation of unit
  - 3. Proper reassembly and sealing of unit segments at shipping splits.
  - 4. Tight seal around perimeter of unit at the roof curb
  - 5. Installation of shipped-loose parts, including filters, air hoods, bird screens and mist eliminators.
  - 6. Completion and tightness of electrical, ductwork and piping connections
  - 7. Tight seals around wiring, conduit and piping penetrations through RTU casing.

8. Supply of electricity from the building's permanent source
9. Integrity of condensate trap for positive or negative pressure operation
10. Condensate traps charged with water
11. Removal of shipping bolts and shipping restraints
12. Sealing of pipe chase floor(s) at penetration locations.
13. Tightness and full motion range of damper linkages (operate manually)
14. Complete installation of control system including end devices and wiring
15. Cleanliness of RTU interior and connecting ductwork
16. Proper service and access clearances
17. Proper installation of filters
18. Filter gauge set to zero

- B. Resolve any non-compliant items prior to proceeding with the inspection of the fan assembly.

### 3.4 INSPECTION AND ADJUSTMENT: RTU FAN ASSEMBLY

- A. Hire the manufacturer's factory-trained and factory-employed service technician perform an inspection of the RTU fan assembly subsequent to general RTU inspection and prior to startup. Technician shall inspect and verify the following as a minimum:
1. Fan isolation base and thrust restraint alignment
  2. Tight set screws on pulleys, bearings and fan
  3. Tight fan bearing bolts
  4. Tight fan and motor sheaves
  5. Tight motor base and mounting bolts
  6. Blower wheel tight and aligned to fan shaft
  7. Sheave alignment and belt tension
  8. Fan discharge alignment with discharge opening
  9. Fan bearing lubrication
  10. Free rotation of moving components (rotate manually)
- B. Manufacturer shall perform service to bring fan performance within factory specifications.

### 3.5 STARTUP SERVICE AND OWNER TRAINING

- A. Manufacturer's factory-trained and factory-employed service technician shall startup RTUs. Technician shall perform the following steps as a minimum:
1. Energize the unit disconnect switch
  2. Verify correct voltage, phases and cycles
  3. Energize fan motor briefly ("bump") and verify correct direction of rotation.
  4. Re-check damper operation; verify that unit cannot and will not operate with all dampers in the closed position.
  5. Energize fan motors and verify that motor FLA is within manufacturer's tolerance of nameplate FLA for each phase.
  6. Rebalance each fan and check for vibration.
- B. Provide a minimum of 2 hours of training for owner's personnel by manufacturer's factory-trained and factory-employed service technician. Training shall include RTU controls, motor

starter, VFD, and RTU.

- C. Training shall include startup and shutdown procedures as well as regular operation and maintenance requirements.
- D. Submit a startup report summarizing any problems found and remedies performed.

### 3.6 CLEANING

- A. Clean unit interior prior to operating. Remove tools, debris, dust and dirt.
- B. Clean exterior prior to transfer to owner.

### 3.7 DOCUMENTATION

- A. Provide Installation Instruction Manual, & Startup checklist in the supply fan section of each unit.
- B. Provide six copies of Spare Parts Manual for owner's project system manual.

END OF SECTION 237300

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SECTION 238127 – IN-CEILING CASSETTE AIR CONDITIONER / HEAT PUMP

PART 1 -- GENERAL

1.1 SYSTEM DESCRIPTION

- A. Indoor, in--ceiling mounted, direct--expansion fan coils are matched with cooling only or heat pump outdoor unit.
- B. Outdoor air--cooled split system compressor sections suitable for on--the--ground, rooftop, wall hung or balcony mounting. Units shall consist of a scroll compressor, an air--cooled coil, propeller--type blow--through outdoor fan, reversing valve (HP), accumulator, Accurator metering device(s), and control box. Units shall discharge air horizontally as shown on the contract drawings. Units shall function as the outdoor component of an air--to--air cooling only, or heat pump system.
- C. Units shall be used in a refrigeration circuit matched to duct--free cooling only or heat pump fan coil units.

1.2 AGENCY LISTINGS

- A. Indoor unit shall be rated per ARI Standards 210/240 and listed in the ARI directory as a matched system. Units shall be certified by UL and CSA.
- B. Outdoor unit construction shall comply with ANSI/ASHRAE 15, latest revision, and with the NEC.
- C. Outdoor units shall be evaluated in accordance with UL standard 1995.
- D. Outdoor units shall be listed in the CEC directory.
- E. Outdoor unit cabinet shall be capable of withstanding 500--hour salt spray test per Federal Test Standard No. 141 (method 6061).
- F. Air--cooled condenser coils shall be leak tested at 573 psig.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Indoor units shall be stored and handled per unit manufacturer's recommendations.
- B. Outdoor units shall be shipped in one (1) piece and shall be stored and handled per unit manufacturer's recommendations.

1.4 WARRANTY

- A. Indoor Unit: 1--year parts limited warranty.

- B. Outdoor Unit: 1--year parts, 5--year compressor limited warranty.

## PART 2 -- PRODUCTS

### 2.1 INDOOR CASSETTE UNIT

A. Acceptable Manufacturers:

1. Mitsubishi Model Number: PLA – A24BA (Basis of Design)
2. Carrier
3. Sanyo
4. LG

B. General:

1. Indoor, direct--expansion, low profile (12 in./ 304.8 mm) in-ceiling fan coil. Unit shall be complete with cooling/heating (heat pump systems only) coil, fan, fan motor, piping connectors, condensate pump, and hanging brackets.

C. Unit Cabinet:

1. Cabinet shall be constructed of zinc--coated steel. Fully insulated discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Grille shall have hinges and can be opened to obtain access to the cleanable filters, indoor fan motor and control box. Adjacent room cooling as well as fresh air intake shall be provided by simple knock--outs in a cabinet side panel.

D. Fans:

1. Fan shall be centrifugal direct--drive blower type with air intake in the center of the unit and discharge at the perimeter. Automatic, motor--driven vertical air sweep shall be provided standard. Automatic motor--driven louvers shall be provided standard and shall be adjustable for 2, 3 or 4--way discharge.
2. Air sweep operation shall be user selectable.

E. Coil:

1. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion and specially coated for enhanced wet--ability. A drip pan under the coil shall have a factory installed condensate pump and drain connection for hose attachment to remove condensate.

F. Motors:

1. Motors shall be open drip--proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be 3--speed.

G. Controls:



1. Controls shall consist of a microprocessor--based control system which shall control space temperature, determine optimum fan speed, and run self diagnostics. The temperature control range shall be from 62°F to 84°F. User interface with the unit shall be accomplished through a wired controller.
2. The unit shall have the following functions as a minimum:
  - a. An automatic restart after power failure at the same operating conditions as at failure.
  - b. A timer function to provide a minimum 24--hour timer cycle for system Auto Start/Stop.
  - c. Temperature--sensing controls shall sense return air temperature.
  - d. Indoor coil freeze protection.
  - e. Automatic air sweep control to provide on or off activation of air sweep louvers.
  - f. Dehumidification mode shall provide increased latent removal capability by modulating system operation and set point temperature.
  - g. Fan--only operation to provide room air circulation when no cooling is required.
  - h. Diagnostics shall provide continuous checks of unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit.
  - i. Fan speed control shall be user--selectable: high, medium, low, or microprocessor controlled automatic operation during all operating modes.
  - j. Automatic heating--to--cooling changeover in heat pump mode. Control shall include deadband to prevent rapid mode cycling between heating and cooling.
  - k. Indoor coil high temperature protection shall be provided to detect excessive indoor discharge temperature when unit is in heat pump mode.
  - l. Cold blow prevention on heat pump units.
  - m. Automatic compensation for air stratification on heat pump units.

H. Filters:

1. Unit shall have filter track with factory--supplied cleanable filters.

I. Electric Heat

1. 40KMQ units shall have 3kw electric heaters factory installed to supplement the heating capacity by heat pump when required

J. Electrical Requirements:

1. Indoor units shall be 208/230--1--60 and require their own power supply. Units with electric heat shall be single power supply. Only control wiring shall run between the indoor and outdoor units.

K. Operating Characteristics:

1. The 40KMC/KMQ, when matched with the appropriate outdoor section, shall have a minimum listed SEER (seasonal energy efficiency ratio) of 13 at ARI conditions, and a minimum HSPF of 7.7.

L. Features:

1. User Interface can be accomplished with:

- a. Wired control shall be capable of controlling one unit or up to six (6) units daisy-chained together
2. Power ventilation kit shall be available to allow up to 20% outside air to be provided.

## 2.2 OUTDOOR UNIT

### A. Acceptable Manufacturers:

1. Mitsubishi Model Number: PUY – A24NHA3 (Basis of Design)
2. Carrier
3. Sanyo
4. LG

### B. General:

1. Factory assembled, single piece, air--cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and the compressor.

### C. Unit Cabinet:

1. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked--enamel finish on inside and outside.
2. Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components.
3. Outdoor compartment shall be isolated and have an acoustic lining to assure quiet operation.
4. Compressor compartment shall be isolated to allow performing diagnostics while the system is running.

### D. Fans:

1. Outdoor fans shall be direct--drive propeller type and shall discharge air horizontally. Fans shall blow air through the outdoor coil.
2. Outdoor fan motors shall be totally--enclosed, single phase motors with class B insulation and permanently-lubricated bearings. Motor shall be protected by internal thermal overload protection.
3. Shaft shall have inherent corrosion resistance.
4. Fan blades shall be metallic and shall be statically and dynamically balanced.
5. Outdoor fan openings shall be equipped with PVC coated metal protective grille over fan.

### E. Compressor:

1. Compressor shall be fully hermetic scroll type.
2. Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from over--temperature and over--current.
3. Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.
4. Compressor assembly shall be installed on rubber vibration isolators.
5. Compressors shall be available in single--phase (sizes 018--036) and three--phase (sizes 035 and 036).

F. Outdoor Coil:

1. Coil shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, which are cleaned, dehydrated, and sealed.

G. Refrigeration Components:

1. Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, reversing valve.

H. Controls and Safeties:

1. Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:
  - a. Controls:
    - A time delay control sequence is provided standard through the fan coil board.
    - Automatic outdoor--fan motor protection.
  - b. Safeties:
    - Diagnostics provided by matched indoor unit.
    - Compressor motor current and temperature overload protection.
    - Outdoor fan failure protection (High Pressure Switch).
    - Low pressure protection.
    - Fusible plug to vent refrigerant safely in case of a fire.

I. Electrical Requirements:

1. All sizes shall operate on single--phase, 60 Hz power at 208/230V or on three--phase, 60 Hz power at either 208/230 or 460 (for size 035 and 036 units).
2. Unit control voltage to the indoor fan coil shall be 24 volts AC.
3. All power and control wiring must be installed per NEC and all local electrical codes.

J. Refrigerant Line Lengths:

1. The unit shall be capable of 200 ft maximum piping, a maximum lift (fan coil above) of 65 ft and a maximum drop (fan coil below) of 200 ft. Accessories will be required to achieve these lengths.

K. Special Features (Field Installed):

1. Low--Ambient Kit: Control shall regulate fan--motor cycles in response to saturated condensing temperature of the unit. The control shall be capable of maintaining a condensing temperature of 100°F ± 10°F with outdoor temperatures to --20°F. Installation of kit shall not require changing the outdoor fan motor.

2. Crankcase Heater
3. Wind baffle
4. Stacking Kit
5. Wall Mounting Kit

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Install units per manufacturer's recommendations.

END OF SECTION 238127

## SECTION 238213 – TERMINAL HEATING UNITS

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SCOPE

- A. The equipment for the various HVAC systems shall be as hereinafter described in this section.

### PART 2 - PRODUCTS

#### 2.1 ELECTRIC BASEBOARD

- A. Acceptable Manufacturers:
  - 1. Berko Model BDBSL (Basis of design)
  - 2. Indeeco
  - 3. Qmark
- B. Furnish and install, where indicated on plans, convector type heaters, suitable for continuous operation.
- C. Enclosure shall be 12-gauge (.080" min.) aluminum extrusion. The one-piece back and bottom shall join to the one-piece top and front utilizing Berko's Snap-Lock design (patent pending).
- D. Both inlet and outlet air grilles shall be punched pencil-proof slots negating the need for mesh under the grille.
- E. Heaters shall be low profile (2-5/8" x 4") and available in length from 24 inches through 10 feet. Additionally, custom length cabinets up to 12 feet with single or multiple heat decks shall be furnished as specified.
- F. Heater lengths, voltages and wattage capacities shall be as indicated on the plans.
- G. The top and front shall be finished with polyester powder paint or anodized.
- H. The nickel-chromium heating element wire shall be encased in a steel sheath for maximum, trouble-free element life.
- I. Aluminum fins shall be pressure bonded to the steel sheath.
- J. Elements shall be centered anchored and shall float freely at each end through high-temperature Noryl bushings.

- K. Control sections, finished to match heaters, shall be furnished as an optional accessory for field installation of controls, or shall be used to house factory-installed controls as specified.
- L. Thermostats, low-voltage control relays, and disconnect switches, may be specified for factory installation in heaters.
- M. Thermostats and disconnect switches are accessible through the grille.
- N. The heater shall be convertible for use as a self-standing unit with pedestal conversion kit.
- O. Pedestals shall be painted steel or anodized aluminum.
- P. Pedestals can either be mounted on or embedded in the floor surface and wiring or conduit brought through the pedestal during installation.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install per manufacturers recommendations.

END OF SECTION 238213

## SECTION 238316 – RADIANT HEATING SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

#### 1.2 SUMMARY

- A. This Section covers the hydronic radiant heating system.
- B. The work in this Section includes, but is not limited to, the following:
  - 1. Complete radiant heating system as shown on the contract documents.
  - 2. Manufacturer-supported system startup and commissioning phase support.

#### 1.3 ACTION SUBMITTALS

- A. General: Provide required submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Product Data: Provide manufacturer's product submittal data, including pressure and temperature rating, oxygen-barrier performance, and fire-performance characteristics.
- C. Shop Drawings: Submit the following piping layouts, calculations and reports.
  - 1. Piping layout scale: 1/4 inch = 1 foot
  - 2. Submit manufacturer's detailed drawings showing layouts, fixing details and piping details of all areas where hydronic radiant systems are indicated. Submit a cross-referenced manifold schedule indicating loop lengths, tubing diameter, flow rate, operating water temperatures, and pressure drop to meet the required heating performance listed on the contract documents along with product and performance data for each component.
  - 3. Indicate all valves, pumps and items of equipment that are required to control and operate the hydronic radiant system heating as shown on the plans and described in the sequence of operations. Submit a valve and pump schedule listing each number, type, size, model and service. Cross reference to supporting product data.
  - 4. Provide calculations that support the heating performance requirements of the hydronic radiant system. These calculations should indicate the slab construction and the depth of the tubing in relation to the exposed surface. Calculations must show the required flow rate, operating temperatures and pressure drops through the system for heating.
  - 5. Submit manifold details, including all connections, fittings, valves and mounting requirements.
  - 6. Submit details for embedded tubing through concrete expansion joints.

7. Provide drawings showing piping manifold locations and installation details.
8. Provide control sequences and requirements for control hardware devices. Indicate compliance and coordination with requirements of other specification sections.
9. Provide piping sample with complete print stream indicating certification of properties.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Provide operation and maintenance manuals for valves, manifolds, and controls.
- B. Closeout Documentation
  1. Submit manufacturer's report detailing that the hydronic radiant system has been installed in accordance with the contract documents and the manufacturer's specified instructions. Provide manufacturer's instructions. Note any exceptions.
  2. Submit start-up report demonstrating that system meets required capacity, is fully functional and commissioned to the satisfaction of system manufacturer.
  3. Provide final as-built drawings indicating tubing layout, manifold locations, zoning and manifold schedules with details required for installation of the system.
  4. Provide documentation indicating that the installer is trained to install the manufacturer's products.
  5. Warranty documents specified herein.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer shall have demonstrated experience on projects of similar size and complexity with documentation proving successful completion of hydronic radiant system installation and/or training by the PEX tubing manufacturer.
- B. Hydronic radiant system manufacturer shall have successfully completed five installations of similar type and scope. Manufacturer shall provide a representative for field support during the installation and commissioning of the hydronic radiant system.
- C. Pre-installation Meetings
  1. Verify project requirements, substrate conditions, floor coverings, manufacturer's installation instructions and warranty requirements.
  2. Review project construction timeline to ensure compliance or discuss modifications as required.
  3. Interface with other trade representatives to verify areas of responsibility.
  4. Establish the frequency and construction phase the project engineer intends for site visits and inspections by the PEX tubing manufacturer's representative.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. General: Comply with Division 1 Product Requirements Section.



- B. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
  - 1. Store PEX tubing in cartons or under cover to avoid dirt or foreign material from entering the tubing.
  - 2. Do not expose PEX tubing to direct sunlight for more than 30 days. If construction delays are encountered, cover the tubing to prevent exposure to direct sunlight.

## 1.7 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.
  - 1. Warranty may transfer to subsequent owners.
  - 2. Warranty Period for PEX Tubing: 30-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of installation.
  - 3. Warranty Period for Manifolds and Fittings: 5-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of installation.
  - 4. Warranty Period for Radiant Rollout Mat: 25-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of installation for tubing. 10-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of installation for in-slab engineered polymer fittings.

## PART 2 - PRODUCTS

### 2.1 CROSSLINKED POLYETHYLENE (PEX) PIPE AND FITTINGS

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
  - 1. Basis of Design Manufacturer: Uponor.
    - a. Contact: 5925 148th Street West, Apple Valley, MN 55124; Telephone: 800.321.4739, 952.891.2000; Fax: 952.891.2008; Website: [www.uponorpro.com](http://www.uponorpro.com)
  - 2. Acceptable Alternate Manufacturers:
    - a. Rehau
    - b. Mr. PEX

- B. To ensure system compatibility consistency, all products, manifolds, components, etc. specified herein must be manufactured by and/or available from the PEX tubing manufacturer.
- C. Tubing
  - 1. Material: Engel-method crosslinked polyethylene (PEX-a)
  - 2. Material Standard: Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third-party agency.
  - 3. Pressure Ratings: Standard Grade hydrostatic design and pressure ratings as issued by the Plastics Pipe Institute (PPI), a division of the Society of the Plastics Industry (SPI).
    - a. 200 degrees F at 80 psi
    - b. 180 degrees F at 100 psi
    - c. 73.4 degrees F at 160 psi
  - 4. Show compliance with ASTM E119 and ANSI/UL 263 through certification listings through UL.
    - a. UL Design No. L557 — 1 hour wood frame floor/ceiling assemblies
    - b. UL Design No. K913 — 2 hour concrete floor/ceiling assemblies
    - c. UL Design No. U372 — 1 hour wood stud/gypsum wallboard wall assemblies
    - d. UL Design No. V444 — 1 hour steel stud/gypsum wallboard wall assemblies
  - 5. Minimum Bend Radius (Cold Bending): Six times the outside diameter.
  - 6. Barrier Tubing Type: Wirsbo hePEX or equal
    - a. Tubing shall have an oxygen-diffusion barrier that does not exceed an oxygen diffusion rate of 0.10 grams per cubic meter per day at 104 degrees F (40 degrees C) water temperature in accordance with German DIN 4726.
    - b. Nominal Inside Diameter: Provide tubing with nominal inside diameter in accordance with ASTM F876, as indicated in the system design.
- D. Fittings
  - 1. ASTM F1960 cold-expansion fitting manufactured from the following material types:
    - a. UNS No. C69300 Lead-free (LF) Brass
    - b. 20% glass-filled polysulfone as specified in ASTM D6394
    - c. Unreinforced polysulfone (group 01, class 1, grade 2) as specified in ASTM D6394
    - d. Polyphenylsulfone (group 03, class 1, grade 2) as specified in ASTM D6394
    - e. Blend of polyphenylsulfone (55-80%) and unreinforced polysulfone (rem.) as specified in ASTM D6394
    - f. Reinforcing cold-expansion rings shall be manufactured from the same source as PEX-a piping manufacturer and marked "F1960".

## 2.2 DISTRIBUTION MANIFOLDS

- A. Brass Manifolds

1. Brass manifolds assemblies shall be constructed of dezincification-resistant brass, with minimum 1-inch barrel, sized for flow rates required on submitted manifold schedule, and R32 union connections.
2. Manifold assemblies shall be furnished and installed with:
  - a. Supply and return filter ball valves
  - b. Supply and return temperature gauges
  - c. Loop balancing and isolation valves
  - d. End cap with vent and drain
  - e. Mounting bracket
  - f. Manual balancing valves with visual flow indicators
  - g. ASTM F1960 fitting assemblies
3. Install flow setter on the return leg from the manifold to provide flow balancing between manifolds.
4. Manifolds support 5/16-inch through 3/4-inch PEX tubing.
5. Each manifold location should have the ability to vent air manually from the system.
6. Use appropriately-sized manifolds cabinets to allow the manifold assemblies to be mounted inside the wall cavity. Provide manifold elbows and offsets, as required.

**B. Engineered Polymer (EP) Manifolds**

1. Engineered Polymer manifolds assemblies shall be constructed of high-density, high impact UDEL polysulfone, Radel R polyphenylsulphone, or Acudel modified polyphenylsulfone, with minimum 1-inch barrel, sized for flow rates required on submitted manifold schedule, and R32 union connections.
2. Manifold assemblies shall be furnished and installed with:
  - a. Supply and return filter ball valves
  - b. Supply and return temperature gauges
  - c. Loop balancing and isolation valves
  - d. End cap with vent and drain
  - e. Mounting bracket
  - f. Manual balancing valves with visual flow indicators
  - g. ASTM F1960 fitting assemblies
3. Install flow setter on the return leg from the manifold to provide flow balancing between manifolds.
4. Manifolds support 5/16 inch through 3/4 inch PEX tubing. Use
5. Each manifold location should have the ability to vent air manually from the system.
6. Use appropriately-sized manifolds cabinets to allow the manifold assemblies to be mounted inside the wall cavity. Provide manifold elbows and offsets, as required.

**C. Stainless-steel Manifolds**

1. Stainless-steel Manifold assemblies shall be constructed of 304L stainless steel, with minimum 1-inch barrel, sized for flow rates required on submitted manifold schedule.
2. Stainless-steel Manifold assemblies shall be furnished and installed with:
  - a. Supply and return filter ball valves with NPT threads
  - b. Supply and return temperature gauges

- c. Loop balancing and isolation valves
  - d. End cap with vent and drain
  - e. Mounting bracket
  - f. Manual balancing valves with visual flow indicators
  - g. ASTM F1960 fitting assemblies
3. Install flow setter on the return leg from the manifold to provide flow balancing between manifolds
  4. Manifolds support 5/16-inch through 3/4-inch PEX tubing.
  5. Each manifold location should have the ability to vent air manually from the system.
  6. Use appropriately-sized manifolds cabinets to allow the manifold assemblies to be mounted inside the wall cavity. Provide manifold elbows and offsets, as required.

D. Copper Manifolds

1. For system compatibility, use 2-inch valved copper manifolds manufactured from Type L copper material, offered by the PEX tubing manufacturer.
2. Install valved copper manifolds primarily for wall-hung or boxed applications.
3. Use manifolds with an isolation valve or a combination isolation and balancing valve on each outlet.
4. Use manifolds that support 5/8 inch or 3/4 inch PEX tubing.
5. Ensure manifold end cap offers tapping for 1/8 inch FNPT and 1/2 inch FNPT for vent and drain.
6. Install supply-and-return piping to the manifold in a reverse-return configuration to ensure self-balancing.
7. If the supply-and-return piping is in direct-return configuration, install and balance flow setters on the return leg of each manifold to the mains.

2.3 PREASSEMBLED RADIANT HEATING AND COOLING ROLLOUT MATS

A. Manufacturer: Uponor

B. Mat Construction

1. Radiant Rollout Mats shall be constructed with 5/8 inch Wirsbo hePEX tubing with loops at 9 inch on center spacing.
2. The mats shall be constructed in nominal widths of 5 feet for 6 inch on center spacing, 4.5 feet for 9 inch on center spacing, and 6-ft. for 12 inch on center spacing with maximum lengths of 225 feet. The mats shall be custom-designed based on the floor plan to ensure that mat pressure drops at the required flow rates will not exceed the scheduled maximums.
3. The mats shall be constructed with acetyl polymer support strips at every seven feet. Tubing shall be secured to the support strips using 6 inch plastic zip ties.
4. Header assembly: In-slab reverse return header assembly shall be constructed of 3/4-inch Wirsbo hePEX with Engineered Polymer (EP) ASTM F1960 cold expansion fittings.

- C. Radiant Rollout Mats shall be pressure tested prior to shipping and shall be delivered to the job site with less than 20 psi of pressure. The mats shall be tagged and permanently labeled according to the shop drawings.

## 2.4 PIPING SPECIALTIES AND ACCESSORIES

- A. Fixing Wire: 6 inch galvanized steel alloy wire ties shall be used to secure PEX tubing to wire mesh or reinforcing bar.
- B. Plastic Cable Tie: Minimum 6 inch polyamide 6/6 nylon cable tie. Minimum 20 lb. tensile strength.
- C. Plastic Foam Staples: 2½ inch Black polypropylene staples shall be used to secure ⅜-inch to ⅝-inch tubing directly onto rigid foam insulation. Ensure that the proper size staples are used for the insulation thickness.
- D. Plastic PEX Rails: 1½-inch wide, 1-inch tall polyethylene plastic rails, with snap fit to hold ⅝ inch tubing with 2 inch spacing intervals.
- E. PVC Bend Supports: 90 degree PVC bend supports shall be used to sleeve tubing at slab penetrations. Bend supports shall be sized for appropriate tubing diameter.
- F. Recessed Manifold Wall Cabinets: Minimum 20-gauge galvanized steel construction with white powder-coat finish. Manifold wall cabinets shall be lockable with removable door-trim package and shall be sized to accommodate the manifolds and associated elbows, valves, pumps, etc. as required by the contract documents.

## 2.5 CONTROLS

- A. Refer to Sections 230900 (Instrumentation and Control for HVAC), Section 230993 (Sequence of Operations for HVAC Controls) and plans for radiant heating controls.

## 2.6 ADDITIONAL REQUIREMENTS

- A. The embedded tubing shall be Uponor 5/8" hePEX barrier tubing installed 9" on center with 14 loops and a 400' maximum loop length. The embedded tubing shall be anchored to 6" x 6" wire mesh supported with chairs or rebar to be provided and installed by the GC. The RFH manifold shall be located in Storage 117 as depicted on the project plans.
- B. The Mechanical Contractor shall provide & install R-10 under slab insulation and vapor retarder under the thermal floor to be heated.
- C. The radiant floor heating manifolds shall be Uponor 2" copper manifolds with per loop isolation ProPEX ball valves on the supply manifold and ProPEX ball & balance valves on the return manifold.
- D. The RFH thermostat shall be a Tekmar programmable, wall-mounted thermostat with one remote slab temperature sensor installed in ¾" PVC conduit embedded in thermal slab by the Mechanical Contractor and one remote air temperature sensor located as depicted on the project plans. The maximum allowable floor temperature shall be 95°F. The thermostat shall be located in Storage 117.

- E. The RFH circulating pump shall be an iron body, maintenance free circulator with 2" cast iron flanges - B&G PL-Series or equal. The RFH circulator to be selected by radiant floor equipment supplier to provide 45 BTUH/SF of radiant floor heat into the thermal slab with a 20°FΔT across the system.
- F. The radiant floor heating equipment manufacturer shall supply an embedded tubing installation plan to be provided to architect/engineer for review and approval as part of submittal phase of the project. The Mechanical contractor shall provide an AutoCAD drawing file to be used by radiant floor heating equipment manufacturer to produce the embedded tubing plan.
- G. The Mechanical contractor shall condition and air pressure-test the installed radiant floor tubing & manifolds utilizing the procedures and methods recommended by Uponor and/or the AHJ. The Mechanical contractor shall demonstrate the system is leak free for 24 hours prior to installation of the concrete floor. The Mechanical contractor shall be on-site during the installation of the concrete to ensure the embedded radiant floor heat tubing and the manifolds are leak-free.
- H. The supply and return piping to the RFH manifolds shall be 2" type L copper tube or Uponor 2" hePEX tubing. The Mechanical contractor shall field insulate all supply & return piping with fiberglass pipe covering and fittings or equivalent as approved by architect/engineer.
- I. The RFH system shall be equipped with a Natural gas fired boiler which shall be a Raypak XPak-FT model H7-198AR wall mounted, 95% certified efficient equipped with a stainless steel fire-tube heat exchanger and fully modulating burners. The boiler burner input shall be 199 MBH input and shall be capable of up to 10:1 turndown. All vent pipe and fittings between the boiler and the vent termination shall be 3" polypropylene when vented/terminated vertically through the roof. All vent pipe and fittings shall be provided by a manufacturer approved by Raypak. PVC & CPVC vent pipe/fittings are not approved for use on this project. Combustion air supply pipe and fittings shall be 3" PVC or CPVC when extended/terminated vertically through the roof. All vent and combustion air pipe and fittings shall be provided and installed by the Mechanical contractor in strict compliance with the boiler manufacturer's instructions. The boiler shall include one outdoor air and one water temperature sensor, a manual reset low water cut-off protection control, a condensate trap, a 120V/24V control transformer, a manual reset high limit control, a manual gas shut-off valve, a 30# ASME pressure relief valve, a combustion test port on the boiler vent connection, an iron body, a maintenance free boiler primary loop circulating pump with 1-1/4" lead-free, ball valve isolation flanges, and a condensate treatment kit. The boiler shall be piped primary/secondary to the RFH system. The boiler, circulating pumps, air separator, air vent, and expansion tank shall be located in Storage 117. PVC or CPVC condensate drain pipes from the boiler shall be provided and installed by the mechanical contractor and shall extend to an appropriate point of disposal as designated and approved by the architect/engineer and/or the AHJ.
- J. The Mechanical contractor shall provide and install a system loop air separator with air vent (B&G IAS or equal), a bladder expansion tank (Wessels N-Series or equal), and a lead-free pressure reducing valve all to be sized by the RFH equipment supplier. The building potable water supply shall be protected by a lead-free reduced pressure zone backflow preventer or one approved by the AHJ and shall be connected to the water supply pipe feeding the RFH system.
- K. The Mechanical contractor shall be responsible for providing a complete and fully functional system understanding not all of the required components may be listed in this performance specification. For the Owner's long term, warranty benefit, all equipment and controls required

for the radiant floor heating system shall be provided to the mechanical contractor from one single supplier approved by the architect and engineer. Contact Jack Getkin at Herrmann Associates at 412-922-7777 for equipment selection, pricing assistance, and system support.

### PART 3 - EXECUTION

#### 3.1 MANUFACTURER'S INSTRUCTIONS

- A. Install radiant heating system according to approved shop drawings or coordination drawings.
- B. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including the following.
  - 1. Uponor Complete Design Assistance Manual (CDAM), current edition
  - 2. Uponor Radiant Floor Installation Handbook, current edition

#### 3.2 EXAMINATION

- A. Site Verification of Conditions
  - 1. Verify that site conditions are acceptable for installation of the hydronic radiant heating system.
  - 2. Do not proceed with installation of the hydronic radiant heating system until unacceptable conditions are corrected.

#### 3.3 INSTALLATION

- A. Slab-on-grade Installation
  - 1. Fasten the tubing to the wire mesh or reinforcing bar using plastic cable ties. Space ties at a maximum of 36 inches. Secure tubing at the base and center of each bend.
  - 2. Fasten the tubing directly onto foam board insulation using plastic foam staples. Use the manufacturer's recommended staple size for the foam board insulation thickness. Space ties at a maximum of 36 inches. Secure tubing at the base and center of each bend.
  - 3. Fasten the tubing using PEX rails. Rails shall be fastened to the insulation foam board using compatible liquid nails or silicone with maximum spacing of 36 inches.
  - 4. Install edge insulation when the controlled system directly contacts an exterior wall.
  - 5. Install tubing at a consistent depth below the surface elevation. Maintain minimum cover as shown on plans. Ensure sufficient clearance to avoid control joint cuts.
  - 6. In areas where tubing must cross expansion joints in the concrete, ensure the tubing passes below the joints. If tubing must pass through an expansion joint, tubing shall be wrapped with pipe insulation for 6 inches on both sides of joint.
  - 7. For tubing that exits the slab in a 90-degree bend, use PVC bend supports.
  - 8. System shall be pressure-tested per the manufacturer's recommendations at a pressure no less than 40 psig. Maintain minimum 40 psig pressure during the concrete pour for 24 hours during curing.

B. Suspended Slab Construction

1. Fasten the tubing to the wire mesh or reinforcing bar using plastic cable ties. Space ties at a maximum of 36 inches. Secure tubing at the base and center of each bend.
2. Fasten the tubing using PEX rails. Rails shall be fastened to the metal deck using compatible liquid nails or silicone with maximum spacing of 36 inches.
3. Install edge insulation when the controlled system directly contacts an exterior wall.
4. Install tubing at a consistent depth below the surface elevation. Maintain minimum cover as shown on plans. Ensure sufficient clearance to avoid control joint cuts.
5. In areas where tubing must cross expansion joints in the concrete, ensure the tubing passes below the joints. If tubing must pass through an expansion joint, tubing shall be wrapped with pipe insulation for 6 inches on both sides of joint.
6. For tubing that exits the slab in a 90-degree bend, use PVC bend supports.
7. System shall be pressure-tested per the manufacturer's recommendations at a pressure no less than 40 psig. Maintain minimum 40 psig pressure during the concrete pour for 24 hours during curing.

C. Topping Installation

1. Fasten the tubing to the wire mesh using plastic cable ties. Space ties at a maximum of 36 inches. Secure tubing at the base and center of each bend.
2. Fasten the tubing directly onto foam board insulation using plastic foam staples. Use the manufacturer's recommended staple size for the foam board insulation thickness. Space ties at a maximum of 36 inches. Secure tubing at the base and center of each bend.
3. Fasten the tubing using PEX rails. Rails shall be fastened to the insulation foam board or structural slab using compatible liquid nails, silicone, or concrete anchors/screws with maximum spacing of 36 inches.
4. Fasten the tubing using a plastic knob mat. Install per manufacturer's recommendations.
5. Install edge insulation when the controlled system directly contacts an exterior wall.
6. Install tubing at a consistent depth below the surface elevation. Maintain minimum cover as shown on plans. Ensure sufficient clearance to avoid control joint cuts.
7. In areas where tubing must cross expansion joints in the concrete, ensure the tubing passes below the joints. If tubing must pass through an expansion joint, tubing shall be wrapped with pipe insulation for 6 inches on both sides of joint.
8. For tubing that exits the slab in a 90-degree bend, use PVC bend supports.
9. System shall be pressure-tested per the manufacturer's recommendations at a pressure no less than 40 psig. Maintain minimum 40 psig pressure during the concrete pour for 24 hours during curing.

D. Manifold Installation

1. Mount manifolds in manifold wall cabinets per the approved shop drawings. Coordinate door panel finish with architectural finish schedule. Install manifold cabinets in accordance with manufacturer's recommendations.

E. All piping to be identified with loop numbers marked on pipe wall before connecting to manifold using a permanent tag.

1. Verify actual loop length for each loop on a manifold.
2. All loops must be identified to allow for future balancing.



- F. Coordinate slab tubing layout with other devices (electrical conduits and boxes, telecommunication conduits and boxes, plumbing penetrations, construction and furniture supports) and all other services within or attaching to the slab. Zones designated on the drawings shall be kept clear of all radiant floor tubing.
- G. Provide survey documentation of tubing layout after installation of tubing and prior to pouring concrete. Notify Owner's Representative three days in advance of concrete pour to allow inspection of installation and survey documentation.

### 3.4 ADJUSTING

- A. Balancing Loops Across the Manifold
  - 1. Balance all loops across each manifold to the flow rates specified on the approved manifold schedule.
  - 2. Balancing is unnecessary when all loop lengths across the manifold are within 3% of each other in length. Install the supply-and-return piping to the manifold in a reverse-return configuration to ensure self-balancing.

### 3.5 CLEANING/RECYCLING

- A. Remove temporary coverings and protection.
- B. Repair or replace damaged installed products.
- C. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.
- D. Remove construction debris from project site and legally dispose of debris. Divert waste tubing and packaging for recycling.

END OF SECTION 238316

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## SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

### PART 1 - GENERAL

#### 1.1 EXECUTION OF THE WORK

- A. The scope of work shown on the drawings and in these specifications, Division 26, 27 and 28 are all a part of this contract and shall be included in the base bid unless otherwise noted.
- B. These Specifications call out certain duties of the Electrical Contractor and/or Subcontractors. They are not intended as a material list of items required by the Contract.
- C. These divisions of the Specifications cover the electrical systems of the project. It includes work performed by the electrical trades as well as trades not normally considered as electrical trades.
- D. Provide all items and work indicated on the Drawings and all items and work called for in the Specifications in accordance with the conditions of Contract (Division 1 General Requirements Documents). This includes all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc., necessary to provide complete systems. Perform start-up and checkout on each item and system to verify the systems are fully operable.
- E. Comply with all provisions of the Contract Documents including Division 1, General Conditions, and Supplementary General Conditions of the Specifications.
- F. Certain terms such as "shall, provide, install, complete, start up" are not used in some parts of these Specifications. This does not indicate that the items shall be less than completely installed or that systems shall be less than complete.
- G. Examine and compare the Electrical Drawings and Specifications with the Drawings and Specifications of other trades and report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the work. At time of bid the most stringent requirements must be included in said bid. Install and coordinate the electrical work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interferences in a manner approved by the Engineer. All changes required in the work of the Contractor caused by neglect shall be corrected at the expense of the Contractor.
- H. It is the intent of the drawings and specifications to provide a complete workable system ready for the Owner's operation. These specifications are equipment and performance specifications. Items described or called out in the specification but not shown on the drawings are considered to be part of the project. Any item not specifically shown on the drawings or called for in the specifications, but normally required to conform to the intent are to be considered a part of the contract. Installation of the equipment shall be in accordance with the N.E.C., manufacturer recommendation, and industry standards.

- I. All material furnished by the Contractor shall be new and unused (temporary lighting and power products are excluded) and free from defects. All materials used shall bear the Underwriters Laboratory, Inc label provided a standard has been established for the material in question.
- J. All products and materials to be new, clean, free of defects and free of damage and corrosion.
- K. No exclusion from, or limitation in, the symbolism used on the Drawings for electrical work or the languages used in the Specifications for electrical work shall be interpreted as a reason for omitting accessories necessary to complete any required system or item of equipment.
- L. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.
- M. Except for conduit, conduit fittings, outlet boxes, wire and cable, all items of equipment or material shall be the product of one manufacturer throughout. Multiple manufacturers will not be permitted.

## 1.2 COORDINATION OF THE WORK

- A. Certain materials will be provided by other trades. Examine the Contract Documents to ascertain these requirements.
- B. Carefully check space requirements with other trades and the physical confines of the area to ensure that all material can be installed in the spaces allotted thereto including finished suspended ceilings. Make modifications thereto as required and approved.
- C. Transmit to other trades all information required for work to be provided under their respective sections in ample time for installation.
- D. Wherever work interconnects with work of other trades, coordinate with other trades to ensure that all trades have the information necessary so that they may properly install all the necessary connections and equipment. Identify all items of work that require access so that the ceiling trade will know where to install access doors and panels.
- E. Due to the type of the installation, a fixed sequence of operation is required to properly install the complete systems. Coordinate, project and schedule work with other trades in accordance with the construction sequence.
- F. The locations of lighting fixtures, outlets, panels and other equipment indicated on the Drawings are approximately correct, but they are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed in consequence of increase or reduction of the number of outlets, or in order to meet field conditions or to coordinate with modular requirements of ceilings, or to simplify the work, or for other legitimate causes.
- G. Exercise particular caution with reference to the location of panels, outlets, switches, etc., and have precise and definite locations approved by the Engineer before proceeding with the installation.

- H. The Drawings show only the general run of raceways and approximate location of outlets. Any significant changes in location of outlets, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Engineer and shall receive approval before such alterations are made. All such modifications shall be made without additional cost to the Owner.
- I. Obtain from the Engineer in the field the location of such outlets or equipment not definitively located on the Drawings.
- J. Circuit "tags" in the form of arrows are used where shown to indicate the home runs of raceways to electrical distribution points. These tags show the circuits in each home run and the panel designation. Show the actual circuit numbers on the finished record tracing and on panel directory card. Where circuiting is not indicated, the Electrical Contractor must provide required circuiting in accordance with the loading indicated on the drawings and/or as directed.
- K. The Drawings generally do not indicate the exact number wires in each conduit for the branch circuit wiring of fixtures, and outlets, or the actual circuiting. Provide the correct wire size and quantity as required by the indicated circuiting and/or circuit numbers indicated and control wiring diagrams, if any, specified voltage drop or maximum distance limitations, and the applicable requirements of the NEC.
- L. Adjust locations of conduits, panels, equipment, pull boxes, fixtures, etc. to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each raceway prior to installation.
  - 1. Right of way: lines which pitch to have the right-of-way over those which do not pitch. For example: steam, condensate, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.
  - 2. Make offsets, transitions and changes in direction in raceways and as required to maintain proper head room in pitch of sloping lines whether or not indicated on the Drawings.
- M. Whenever the work is of sufficient complexity, prepare additional Detail Drawings to scale similar to that of the bidding Drawings, prepared on tracing medium of the same size as Contract Drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the Drawings as to the area to which it applies. Submit for review Drawings clearly showing the work and its relation to the work of other trades before commencing shop fabrication or erection in the field.
- N. Contractor shall furnish services of experienced Superintendent, who shall be in constant charge of all work, and who shall coordinate his work with the work of other trades. No work shall be installed before coordinating with other trades.

### 1.3 EXAMINATION OF SITE

- A. Prior to submitting of bids, the Contractor shall visit the site of the job and shall familiarize himself with all conditions affecting the proposed installation and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph will in no way relieve the Contractor of performing all necessary work shown on the Drawings.

1.4 PROGRESS OF WORK

- A. The Contractor shall order the progress of his work so as to conform to the progress of the work of other trades and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from the defective or ill-timed work performed under this section shall be borne by the Contractor.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship and store all products and materials in a manner which will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement or repair. Any such repairs shall be subject to review and acceptance of the Engineer.
- B. Delivery of Materials: Deliver materials (except bulk materials) in manufacturer's unopened container fully identified with manufacturer's name, trade name, type, class, grade, size and color.
- C. Storage of Materials, Equipment and Fixtures: Store materials suitably sheltered from the elements, but readily accessible for inspection by the Engineer until installed. Store all items subject to moisture damage in dry, heated spaces.

1.6 EQUIPMENT ACCESSORIES

- A. Establish sizes and location of the various concrete bases required. Coordinate with General Contractor and provide all necessary anchor bolts together with templates for holding these bolts in position.
- B. Provide supports, hangers and auxiliary structural members required for support of the work.
- C. Furnish and set all sleeves for passage of raceways through structural, masonry and concrete walls and floors and elsewhere as will be required for the proper protection of each raceway and passing through building surfaces.
- D. Wall mounted equipment, total weight of 100 pounds or less, may be directly secured to wall by means of steel bolts. Maintain at least 1" air space between equipment and supporting wall. Groups or arrays of equipment, with total weight of more than 100 pounds, shall be mounted on adequately free standing sized steel angles, channels, or bars. Prefabricated steel channels providing a high degree of mounting flexibility, such as those manufactured by Kindorf, Globe-Strutt and Unistrut, may be used for mounting arrays of equipment.

1.7 CUTTING, PATCHING, ETC.

- A. The work shall be carefully laid out in advance. Where Cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of raceway, outlets or other equipment, the work shall be carefully done. Any damage to the building, piping, equipment or defaced finish plaster, woodwork, metalwork, etc. shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner.
- B. The Contractor shall do no cutting, channeling, chasing or drilling of unfinished masonry, tile, etc., unless he first obtains permission from the Engineer. If permission is granted, the Contractor shall perform this work in a manner approved by the Engineer.
- C. Where conduits, outlet, junction, or pullboxes are mounted on a painted surface, or a surface to be painted, they shall be painted to match the surface. Whenever support channels are cut, the bare metal shall be cold galvanized.
- D. Slots, chases, openings and recesses through floors, walls, ceilings, and roofs will be provided by the various trades in their respective materials. The trade requiring them to properly locate such openings and be responsible for any cutting and patching caused by the neglect to do so.

#### 1.8 NOMINAL VOLTAGES (UNLESS OTHERWISE NOTED)

- A. Primary distribution: 277/480 volt, 3 phase, 4 wire.
- B. Secondary Distribution: 120/208 volt, 3 phase, 4 wire.

#### 1.9 MOUNTING HEIGHTS

- A. Unless otherwise noted or required because of special conditions, locate outlets as follows:
  - 1. Heights listed are from finished floor to center of device. Verify exact locations with the Engineer before installation.
    - a. Wall switch outlets .....40"
    - b. Bracket outlets .....7'- 0" to bottom
    - c. Convenience outlets (general) .....18"
    - d. Convenience outlets (mechanical areas) .....4' - 0"
    - e. Panelboard and distribution cabinet to top .....6' - 6"
    - f. Fire alarm audio unit.....Lower of 80" AFF or 6" below ceiling
    - g. Fire alarm visual unit.....80" to bottom or 96" to top AFF
    - h. Fire alarm stations .....40" to top
    - i. Desk telephone outlets.....18"
    - j. Wall telephone outlets .....4' - 9"
    - k. Desk intercommunication outlets .....1' - 6"
    - l. Television outlets .....1' - 6"
    - m. Pushbuttons .....4' - 8"
    - n. Loudspeakers (corridors).....1' - 0"

#### 1.10 CLEANING UP

- A. Contractor shall take care to avoid accumulation of debris, boxes, crates, etc. resulting from the installation of work. Contractor shall remove from the premises each day all debris, boxes, etc., and keep the premises clean, subject to the Architect's instructions, which shall be promptly carried out.
- B. Contractor shall clean all fixtures and equipment at the completion of the project.
- C. All switchboards, panelboards, wireway, trench ducts, cabinets, enclosures, etc. shall be thoroughly vacuumed clean prior to energizing equipment at the completion of the project. Equipment shall be opened for observation by the Architect as required.

#### 1.11 WATERPROOFING

- A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, perform it prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings. Perform work so as to maintain any warranties currently in effect.
- B. If this Contractor penetrates any walls or surfaces after they have been waterproofed, this Contractor shall restore the waterproof integrity of that surface at the expense of this Contractor and as directed by the Architect.

#### 1.12 PRODUCTS

- A. If products and materials are specified or indicated on the drawings for a specific item or system, use those products or materials. Where noted in other sections of this specification, equipment has been specified for a specific performance and substitutions are not permitted. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of Shop Drawings where Shop Drawings are required or as approved in writing where Shop Drawings are not required.

#### 1.13 OMISSIONS FROM THE DRAWINGS

- A. Should a Bidder find discrepancies in or omissions from the drawings or specifications or be in doubt as to their meaning, he shall notify the Architect before submitting his proposal. The Architect will in turn, send written instructions to all Bidders. Neither the Architect nor the Owner will be responsible for oral instructions. If the Contractor fails to comply with this requirement, he shall accept the Engineer's interpretations as to the intended meaning of the drawings and specifications.

#### 1.14 EXECUTION

- A. Follow manufacturer's instructions for installing, connecting, and adjusting all equipment. Provide one copy of such instructions to the Architect before installing any equipment. Provide a copy of such instructions at the equipment during any work on the equipment. Provide all special supports, connections, wiring, accessories, etc.



- B. Use mechanics skilled in their trade for all work.
  - C. Clean all items before and after installation. Clean up all debris.
  - D. Perform all tests required by local authorities in addition to tests specified herein, such as life safety systems.
  - E. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, NEMA, ANSI or IEEE standards and as approved by local authorities having jurisdiction.
  - F. Before commencing work, examine all adjoining, underlying, etc., work on which this work is in any way dependent for perfect workmanship and report any condition which prevents performance of first class work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
- 1.15 VERIFICATION OF ELECTRICAL REQUIREMENTS FOR EQUIPMENT FURNISHED BY OTHERS
- A. Prior to the installation of wiring systems for any equipment furnished by others, this contractor shall verify that the electrical requirements of the equipment match those shown on the electrical drawings by examining the approved shop drawings of that equipment. Any discrepancies shall be immediately reported to the engineer.
  - B. If the contractor fails to comply with this requirement, he shall be responsible for any additional costs incurred at no additional cost to the Owner.
- 1.16 PROTECTION OF BUILDING FIRE/SMOKE BARRIERS
- A. Passages of conduit through fire barriers and/or smoke barriers shall be protected as follows:
    - 1. The space between the penetrating item and the fire barrier and/or smoke barrier shall be filled with a material capable of maintaining the fire/smoke resistance of the barrier or be protected by an approved device designed for the specific purpose.
    - 2. Where the penetrating item uses a sleeve to penetrate the fire and/or smoke barrier the sleeve shall be solidly set in the fire/smoke barrier and the space between the item and the sleeve shall be filled as described above.
    - 3. Fire barriers shall include 1-hour, 2-hour, and 3-hour rated floors and walls. Refer to architectural plans for location of fire barriers and smoke barriers and provide protection required to maintain ratings in accordance with all codes.
    - 4. Approved fill material for fire barriers shall be packed mineral wool, with ASTM E-136 rating and 3M Fire Barrier caulk. Coordinate sealing of all openings with requirements of Division 7 of this specification.
    - 5. Perform work in accordance with the appropriate UL Ratings.
    - 6. Product Data: Provide manufacturer's specifications, recommendations and installation instructions for each application.
- 1.17 CODES AND FEES

- A. General: Comply with Codes in accordance with the Contract Documents.
- B. The electrical installation shall be in compliance with the requirements of OSHA, NEC and the rules, regulations and requirements of the power company supplying power to the building.
- C. The electrical installation shall comply fully with all township, county and state laws, ordinances and regulations applicable to electrical installations.
- D. All equipment shall be equal to or exceed the minimum requirements of NEMA, IEEE and UL.
- E. Should any change in Drawings or Specifications be required to comply with governmental regulations, the Contractor shall notify Architects prior to execution of the work. The work shall be carried out according to the requirements of such code in accordance with the instruction of the Architect and at no additional cost to the Owner.
- F. The local fees and permits and services of inspection authorities shall be obtained and paid for by the Contractor. The Contractor shall cooperate fully with local utility companies with respect to their services.
- G. Certificate of Inspection and approval shall be procured and paid for by this Contractor from an approved certified inspection agency.

1.18 GUARANTEE

- A. General: Provide a Guarantee in accordance with the Contract Documents.
- B. Submit a single guarantee stating that all portions of the work are in accordance with Contract requirements. Guarantee all work against faulty and improper material and workmanship for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, such longer term to apply. Within 24 hours after notification, correct any deficiencies which occur during the guarantee period at no additional cost to Owner, all to the satisfaction of the Owner and Architect. Obtain similar guarantees from subcontractors, manufacturers, suppliers and subtrade specialists.

1.19 DISPOSAL

- A. All electrical items not designated by the Owner for his use to be properly disposed of according to local, state and Federal regulations.
- B. Items containing polychlorinated biphenyl (PCB) to be removed, transported and disposed of according to Federal Toxic Substances Control Act (TSCA). Contractor to submit certification that these items have been properly disposed.

1.20 EXCAVATION AND TRENCHING

- A. Provide excavation for the work. Excavate all material encountered to the depths indicated on the Drawings or required. Remove from the site excavated materials not required or suitable for backfill. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water accumulating therein. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel.
- B. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Where rock excavations are required, excavate rock to a minimum overdepth of 4 inches below the trench depths indicated on the Drawings or required. Backfill overdepths in the rock excavation and unauthorized overdepths with loose, granular, moist earth, thoroughly machine tamped to a compaction level as specified by the Engineer. Whenever unstable soil incapable of properly supporting the work is encountered in the bottom of the trench as determined by the Engineer, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.
  - 1. Primary electric service: 4 feet (minimum).
  - 2. Secondary electric service: 2 feet (minimum).
  - 3. Telephone service: 2 feet (minimum).

#### 1.21 BACKFILLING OF TRENCHES

- A. Do not backfill trenches until all required tests have been performed and the installation observed by the Engineer. Comply with the requirements of other sections of these Specifications. Deposit backfill in 6 inch layers and thoroughly and carefully tamp until for work has a cover of not less than 1 foot. Backfill and tamp remainder of trench at 12 inch intervals until complete. Uniformly grade the finished surface. Install a 6 inch marking ribbon 12 inches below finished grade.

END OF SECTION 260500

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## SECTION 260500.10 – ABBREVIATIONS AND DEFINITIONS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Utilize the following abbreviations and definitions for discernment within the Drawings and Specifications.

1. Abbreviations

- a. NEC National Electrical Code
- b. OSHA Occupational Safety and Health Act
- c. ANSI American National Standards Institute
- d. NFPA National Fire Protection Association
- e. ASA American Standards Association
- f. IEEE Institute of Electrical and Electronics Engineers
- g. NEMA National Electrical Manufacturers Association
- h. UL Underwriters' Laboratories, Inc.
- i. IES Illuminating Engineering Society
- j. ICEA Insulated Cable Engineers Association
- k. ASTM American Society of Testing Materials
- l. ETL Electrical Testing Laboratories, Inc.
- m. CBM Certified Ballast Manufacturers
- n. EIA Electronic Industries Association
- o. OEM Original Equipment Manufacturer
- p. ADA Americans with Disabilities Act

2. Definitions

- a. "PROVIDE" means to supply, purchase, transport, place, erect, connect, test and turn over to Owner, complete and ready for regular operation, the particular work referred to.
- b. "INSTALL" means to join, unite, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation, the particular work referred to.
- c. "FURNISH" means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application for the particular work referred to.
- d. "WIRING" means the inclusion of all raceways fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such work.
- e. "CONDUIT" means the inclusion of all fittings, hangers, supports, sleeves, etc.
- f. "AS DIRECTED" means as directed by the Architect or his representative.
- g. "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions or installed within hung ceilings.

END OF SECTION 260500.10

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SECTION 260500.15 – WORK INCLUDED

PART 1 - GENERAL

1.1 DESCRIPTION

- A. General: Provide the work included in accordance with the Contract Documents.
- B. Provide all labor, materials, equipment, tools, appliances, auxiliaries, services, hoisting, scaffolding, support, supervisions, Project Record Documents, and perform all operations noted in the Documents. Perform all operations for the furnishing and installation of the complete electrical system, including, but not limited to, the work described hereinafter. The work shall meet or exceed the latest codes, regulations and requirements of the state and local community.
- C. The electrical work is shown schematically on the Drawings to indicate the general system arrangement and configuration. The work of this Division shall include coordination with the work of other Divisions of the Specifications and the Contract Documents so as to provide complete and operational systems capable of being readily operated and maintained, to the Owner's satisfaction.
- D. The work includes, but is not limited to the following:
  - 1. Alterations and additions to existing power distribution system
  - 2. Emergency lighting system
  - 3. Alterations and addition to existing building facilities
  - 4. Lighting system
  - 5. Power distribution system
  - 6. Telecommunication system
  - 7. Fire alarm system
  - 8. Grounding system
  - 9. Connection to owner furnished equipment
  - 10. Connection to HVAC and plumbing equipment
  - 11. Transformers
  - 12. Cable tray
  - 13. CATV system
  - 14. Monitoring system
  - 15. Security system
  - 16. Television system
  - 17. UPS system
  - 18. Short circuit/coordination/flash hazard study

END OF SECTION 260500.15

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## SECTION 260500.17 – REVIEWS AND ACCEPTANCES

### PART 1 - GENERAL

#### 1.1 SUBSTITUTION OF MATERIALS OR EQUIPMENT

- A. Reference shall be made to Division 012500 "Substitutions Procedures", for substitution of material or equipment in this Division of the Specifications.

#### 1.2 SHOP DRAWINGS

- A. Prepare and submit detailed shop drawings for materials, systems and equipment as listed herein, including locations and sizes of all openings in floor decks, walls and floors.
- B. The work described in any shop drawing submission shall be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and proper condition with all trades on the job. Each submitted shop drawing shall include a certification that all related job conditions have been checked and that no conflict exists.
- C. All drawings shall be submitted sufficiently in advance of final requirements to allow ample time for checking and resubmittal as may be required. All submittals shall be complete and contain all required and detailed information.
- D. Acceptance of any submitted data or shop drawings for material, equipment apparatus, devices, arrangement and layout shall not relieve Contractor from responsibility of furnishing same of proper dimensions and weight, capacities, sizes, quantity, quality and installation details to efficiently perform the requirements and intent of the contract. Such acceptance shall not relieve contractor from responsibility for errors, omissions or inadequacies of any sort on submitted data or shop drawings.
- E. Each shop drawing shall contain job title and reference to the applicable drawing and specification article.

#### 1.3 SHOP DRAWING SUBMITTALS

- A. Certified Submittals
  - 1. All electrical materials, devices, appliances and equipment shall be labeled and listed by a certified testing laboratory or agency.
- B. Submit for the Architect's approval shop drawings of the following and any other shop drawings requested:
  - 1. Panelboards
  - 2. Cabinets

3. Lighting fixtures
4. Fire alarm and security system
5. Safety switches
6. Wiring devices
7. Generator and Automatic Transfer Switches
8. Sound system
9. Surge protective devices
10. Building communication system
11. Cat 6 cabling system and devices
12. Television distribution system and devices
13. Security systems and devices

END OF SECTION 260500.17

## SECTION 260500.19 - MAINTENANCE MANUALS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. General: Provide maintenance manuals in accordance with the Contract Documents.

#### 1.2 SUBMITTALS

- A. Provide three (3) copies of each manual.
- B. Manuals to be 8-1/2 inches x 11 inches size in hard back 3-ring loose-leaf binders. Use more than one volume if required; do not overfill binders.
- C. Submit one (1) copy to Architect. After review and acceptance, assemble other copies.
- D. Manuals to be completed and in Owner's hands prior to turning building over to Owner and at least 10 days prior to instruction to operating personnel.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS' LITERATURE

- A. General: Provide manufacturers' literature on all items of equipment and components as regularly published by the respective manufacturers for proper preventative and comprehensive maintenance.

### PART 3 - EXECUTION

#### 3.1 PROVIDE MAINTENANCE MANUALS INCLUDING BUT NOT LIMITED TO THE FOLLOWING:

- A. Alphabetical list of all system components, with the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.
- B. Operating instructions for complete system including:
  - 1. Normal starting, operating, and shut-down.
  - 2. Emergency procedures for fire or failure of major equipment.
- C. Maintenance instructions including:

1. Proper lubricants and lubricating instructions for each piece of equipment, and date when lubricated.
  2. This shall be a separate list in addition to manufacturers' data.
  3. Necessary cleaning, replacement and/or adjustment schedule.
- D. Manufacturers' data on each piece of equipment including:
1. Installation instructions.
  2. Drawings and specifications.
  3. Parts list, including recommended items to be stocked.
  4. Complete wiring diagrams.
  5. Marked or changed prints locating all concealed parts and all variations from the original system design.
  6. Test and inspection certificates.

END OF SECTION 260500.19

## SECTION 260500.20 – SPECIAL ELECTRICAL PROJECT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SHUTDOWNS

- A. Shutdowns must be kept to a minimum. Install temporary feeders where required. A two-week written approval must be obtained from the owner prior to any shutdowns.
- B. Shutdowns will not be permitted between the hours of 6:00 a.m. to 6:00 p.m. Monday through Saturday.
- C. This Contractor must include in his base bid the premium time for all shutdowns necessary to complete his work.

#### 1.2 TEMPORARY CONSTRUCTION POWER

- A. Temporary construction power at 480/277 volt, 3 phase, 4 wire and 208/120 volt, 3 phase, 4 wire shall be furnished, installed and removed at the completion of the project. Temporary power distribution system shall be as detailed on the plans.
- B. Temporary power and light within the building shall be as specified in the General Conditions of the specifications.

END OF SECTION 260500.20

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## SECTION 260500.22 – EQUIPMENT WIRING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. General: Provide final connections to equipment and coordinate same in accordance with the Contract Documents.
- B. Equipment to receive final connections shall include, but not be limited to the following:
  - 1. Mechanical equipment
  - 2. Appliances
  - 3. Miscellaneous equipment
  - 4. Owner furnished equipment

#### 1.2 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
  - 1. American National Standard Safety Code for Elevators, Dumbwaiters and Moving Walks (ANSI A17.2).

#### 1.3 EXAMINATION OF DOCUMENTS

- A. Prior to the submitting of bids, the Contractor shall familiarize himself with all conditions affecting the proposed installation of equipment requiring electrical connections and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph shall in no way relieve the Contractor of performing all necessary work required for final electrical connections and equipment.

### PART 2 - PRODUCTS

#### 2.1 NOT APPLICABLE TO THIS SECTION

### PART 3 - EXECUTION

#### 3.1 MECHANICAL EQUIPMENT

- A. All power wiring and connections for all motors including starters, controllers, and breakers as indicated on the drawings and the riser diagrams shall be furnished and installed under this section of the specifications.

- B. Motors shall be connected in a neat and skillful manner. Ones delivered with terminal boxes that are inadequate shall be equipped with special boxes that suit the conditions.
- C. In general, rigid conduit or tubing shall be used, but motors that require movement or ones that would transmit vibration to conduit shall be wired with liquid tight flexible steel conduit not over 18" long.
- D. All motors shall be grounded with a green covered ground wire run inside the conduit and connected to motor frame on one end and to grounding system on the other end.
- E. Motors and their starters not located in the motor control center are only approximately located on the drawings and the Contractor shall allow for the relocation that developed conditions may demand.
- F. The location of motors, starters and control equipment and the arrangement to be followed shall be determined on the job jointly by the Contractor whose equipment is involved, this Contractor and the Architect.
- G. Starting equipment shall be either wall mounted or free standing, as best suits conditions. If free standing, this Contractor shall make and install a suitable frame of structural steel to accommodate it.
- H. Furnish and install one motor snap switch of the proper size for disconnect of each single phase motor indicated on the drawings.

### 3.2 CONTROL WIRING

- A. Control wiring for HVAC and Plumbing equipment will be furnished and installed by Plumbing and HVAC Contractor as Specified in Divisions 22 and 23.
- B. All control wiring in Divisions 22 and 23 is the responsibility of the contractor who provides the particular equipment. Control wiring includes the providing of all required motor controls, relays, pilot devices, all related raceway systems, all related conductors and all final connections other than three phase power connections.
- C. For single phase equipment provided under HVAC and Plumbing Contracts, this Contractor shall provide single phase feeders and make final connection thru the control device.
- D. All other control wiring required by other Divisions of the Specifications shall be furnished and installed by this Contractor. Unless specifically indicated on the drawings or specified hereinafter to the contrary, all control devices such as starters, pushbuttons, limit switches, etc., are furnished under other Divisions of the Specifications. This Contractor shall receive and store all electrical equipment to be installed by him. Conduit and layout and arrangement of control wiring shall be done by this Contractor.

### 3.3 EQUIPMENT CONNECTIONS



- A. This contractor shall make final connections to all electrical equipment. Coordinate with equipment supplier for size and location of all final connections. Contractor to match receptacle with plugs of equipment supplied by others.

END OF SECTION 260500.22

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## SECTION 260500.24 – FOOD SERVICE EQUIPMENT

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. General: Provide final electrical connections and control wiring to kitchen equipment.
- B. Related Work Specified Elsewhere
  - 1. Kitchen equipment.
  - 2. Kitchen hood extinguishing systems.

#### 1.2 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
  - 1. Food and Drug Administration
  - 2. NFPA-96

#### 1.3 EXAMINATION OF DOCUMENTS

- A. Prior to the submitting of bids, the Contractor shall familiarize himself with all conditions affecting the proposed installation of kitchen equipment and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph shall in no way relieve the Contractor of performing all necessary work required for final connections and control wiring of kitchen equipment.

### PART 2 - PRODUCTS

#### 2.1 NOT APPLICABLE TO THIS SECTION

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF KITCHEN EQUIPMENT

- A. Electrical Contractor to coordinate with kitchen equipment Contractor as to final equipment locations and type of connection. No extras will be given for kitchen equipment relocations due to field conditions.

#### 3.2 KITCHEN EQUIPMENT CONNECTIONS

- A. The Electrical Contractor is to furnish the following electrical equipment/devices and make the following connections, but is not limited to:
1. All junction boxes, electrical outlets, stainless steel coverplates and switches not built into kitchen equipment.
  2. All plugs and cords as noted on kitchen consultant's schedules.
  3. Furnish and install shunt-trip branch circuit breakers or shunt-trip main circuit breakers as indicated and disconnect switches for fire control system shut-off of kitchen equipment below hoods or ventilators as shown on the kitchen consultant's documents or the electrical documents.
  4. Disconnect switches or other similar devices as required by code.
  5. To provide conduit and wiring, installation of electrical devices furnished by kitchen equipment contractor and interwire between the following:
    - a. Remote refrigeration equipment to evaporative coils.
    - b. Control panels to water-type ventilators and exhaust/supply fans.
    - c. Kitchen exhaust hoods/ventilators to fire control system and shut-offs.
- B. All outlets and connections shown on electrical kitchen drawings are indicated for kitchen equipment only. Refer to electrical drawing(s) which indicates the general areas for outlets and devices for general purpose use.
- C. The electrical kitchen plans indicate outlet type and location, and connection positions and loads. For final rough-in locations, refer to kitchen consultant's dimensioned plans. All dimensions shown are from finished floor and finished walls, unless otherwise noted.
- D. Internal electrical work for fabricated food service equipment shall be internally wired and connected by kitchen equipment manufacturer for all kitchen equipment, except as noted. Refer to electrical document for food service equipment which, because of physical size, will be delivered to job site in two or more pieces. In such case, Electrical Contractor shall make final connection(s) to make a single piece of food service equipment.
- E. All electrical work for fabricated food service equipment shall be completely wired by kitchen equipment manufacturer (except as noted above), to a junction box or pullbox mounted on the equipment in an accessible position. Final connections between equipment, junction or pullboxes to the electrical panelboard (except as noted) to be the responsibility of the Electrical Contractor.
- F. Electrical Contractor shall furnish and install size, type and quantity of beverage dispensing raceways as indicated on the electrical documents. Final connections to be verified with kitchen consultant.

END OF SECTION 260500.24

## SECTION 260508 - TESTING, ACCEPTANCES, AND CERTIFICATIONS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. General: Complete testing of equipment and systems shall be provided throughout in accordance with the Contract Documents.

#### 1.2 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents comply with the latest applicable provisions and the latest recommendations of the following:

- 1. Industry standards shall apply except as otherwise specified.

#### 1.3 APPLICABLE CODES, STANDARDS AND REFERENCES

- A. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.

- 1. National Electrical Manufacturer's Association – NEMA
  - 2. American National Standards Institute – ANSI
  - 3. Institute of Electrical and Electronic Engineers – IEEE
  - 4. National Electrical Code – NEC
  - 5. National Fire Protection Association – NFPA
  - 6. American Society for Testing and Materials – ASTM
  - 7. Insulated Power Cable Engineers Association – IPCEA
  - 8. Association of Edison Illuminating Companies – AEIC
  - 9. Occupational Safety and Health Administration – OSHA
  - 10. State and local codes and ordinances
  - 11. Applicable Independent Testing Associations Specifications

- B. All inspections and tests shall utilize the following references:

- 1. Project design specifications
  - 2. Project design drawings
  - 3. Manufacturer's instruction manuals applicable to each particular apparatus.

#### 1.4 SUBMITTALS

- A. The test report shall include the following:

- 1. Summary of project
  - 2. Description of equipment tested

3. Description of test
4. Test results
5. Conclusions and recommendations
6. Appendix, including appropriate test forms
7. List of test equipment used and calibration date
8. Conditions for future access to secured computer database of all Test Data.

- B. Furnish three copies of the completed report to the project engineer no later than 30 days after completion of the project, unless directed otherwise.

## 1.5 SAFETY AND PRECAUTIONS

- A. Safety practices shall include, but are not limited to, the following requirements:
1. Occupational Safety and Health Act of 1970 – OSHA 29CFR 1910.269
  2. National Fire Protection Association – NFPA 70E
  3. Applicable state and local safety operating procedures.
- B. All tests shall be performed with apparatus de-energized except where otherwise specified.
- C. The engineering service testing group's lead test engineer for the project shall be a designated safety representative and shall be present on the project and supervise testing operations and safety requirements.
- D. Power circuits shall have conductors shorted to ground by a hotline grounded device approved for the purpose in accordance with the appropriate test procedures.
- E. In all cases, work shall not proceed until the safety representative has determined that it is safe to do so.
- F. The engineering service testing group shall have available sufficient protective barriers and warning signs, where necessary, to conduct specified tests safely.
- G. The owner's safety procedures shall be reviewed and understood by the engineering service testing group personnel.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Provide all labor, premium labor and materials required by shop and field testing as specified in the Contract Documents and as required by the authorities having jurisdiction.

### 2.2 SYSTEMS

- A. The following systems are to be tested, inspected and certified.

1. Wire and Cable (600 Volts and Below)
  - a. Inspect all splices and terminations and make mechanically and electrically tight during a fifteen (15) day period immediately prior to final acceptance of the work.
  - b. Insulation System – To ensure integrity of the cable insulation system after shipping, site storage, and pulling through conduit an insulation resistance test will reveal insulation deformities and moisture in the cable that otherwise might cause an untimely premature cable failure possibly damaging equipment or personnel. Perform the following on all customer power cables to and from main switchboard. This would include cables from utility transformer to MSB and cables from MSB to all secondary switchboards or distribution panels.
  - c. Visually inspect visible portion of cables for observable defects.
  - d. Ensure all solid-state devices are disconnected from the system prior to meggering. Typically, but not all-inclusive would be Meters, trip units with voltage sensing, and SPD units.
  - e. Isolate cables by opening breakers. Meggering thru equipment like motors or transformers will produce erroneous readings.
  - f. Perform insulation-resistance tests on each line and load cable, phase-to-phase, phase-to-ground, phase-to-neutral and neutral-to-ground in each conduit. Megger at 1000 VDC for 600 volt cable and 500 VDC for 300 volt cable for one minute.
  - g. Insulation resistance shall be above 100 ohms and preferably above one megohm.
  - h. Ensure cable termination connections are tight after testing.
2. Motors
  - a. Test all motors under load and verify that motor rotation is correct.
3. Fire Alarm Systems
  - a. All wiring must be inspected and tested to insure, that there are not grounds, opens or shorts. The minimum allowable resistance between any two conductors or between conductors and ground is ten (10) megohms as measured with a 500 volt meager after all conduit, conductors, detector bases, etc., have been installed, but before the detector devices are plugged into the bases or end-of-line devices installed.
  - b. The Contractor must perform all electrical and mechanical tests required by the equipment manufacturer's form. All test and report costs must be in the Contract price. A checkout report is to be prepared by the technician and submitted in triplicate, one copy of which will be registered with the equipment manufacturer. The report is to include, but not be limited to:
    - 1) A complete list of equipment installed and wired.
    - 2) Indication that all equipment is properly installed and functions and conforms with these specifications.
    - 3) Tests of individual zones as applicable.
    - 4) Serial numbers, locations by zone and model number for each installed detector.
    - 5) Voltage (sensitivity) settings for each ionization detector as measured in place.
    - 6) Response time on detectors.
    - 7) Contractor shall submit a certified report indicating the following:

- a) Operating all manual stations and all detectors that can be reset.
- b) Verifying line supervision of each initiating and indicating circuit.
- c) Verifying the operation of each initiating circuit.
- d) Verifying the operation of all indicating devices.
- e) Verifying the operation of all alarm- initiated functions.
- f) Verifying full operation of the F.C.I.P.

4. Ballasts

- a. Submit manufacturer's certification that ballasts and transformers for discharge type lamps comply with the latest C.B.M. specifications which have been issued.

PART 3 - EXECUTION

3.1 GENERAL

- A. Notify the Architect seven (7) days prior to the testing dates. If the Architect so elects not to witness a specific test a statement of certification must be forwarded to the Architect for his approval.
- B. Conduct tests at a time agreeable to the Architect. Provide premium labor as necessary.
- C. Products which are found defective or do not pass such tests shall be removed and replaced at the Contractor's expense. Tests shall be repeated.
- D. Conduct all test required by the authorities having jurisdiction.

3.2 RESTORATION OF EQUIPMENT AND REPORTS

- A. Before Energizing
  - 1. Remove and account for all test equipment, jumper wires, and tools used during testing.
  - 2. Remove and account for safety grounds and tools.
  - 3. Replace all barriers and covers, close all doors, and secure all latches.
  - 4. Remove safety locks and tags.
  - 5. Ensure all adjustable meters, relays and trip devices are properly set in accordance with the coordination study.
  - 6. Apply testing label to equipment
- B. Note corrective actions taken, deficiencies, recommendations and any general comments.
- C. Finish recording data on test forms, completely filling in the blanks. Enter into electronic database as required in section 1.4.E
- D. Turn in 3 copies of report to engineer for approval.

3.3 FOLLOW UP TESTING



- A. Included in above cost as part of original project.
- B. One month prior to the expiration of the factory warranty schedule & perform a thermal scan of all breaker to cable, breaker, bus connections, cable to panel chassis. Scope is to include main transformer connections, main switchboard, all secondary switchboards, transformers, and panels. Tests are to be done with building normal loaded for 2 hours, not with partial or unloaded condition.
- C. Thermal scan temperatures shall be evaluated as follows (based on comparable size or adjacent phases and loaded breakers, bus connections, and terminations)
  - 1. 1-3 degrees C rise, Investigate as to the cause of temp rise.
  - 2. 4 – 15 degree C rise, Repair as soon as possible.
  - 3. 16 or higher degree C rise, Repair immediately.
- D. Ensure that all bus and breaker to cable connections are tight.
- E. Note corrective actions taken, deficiencies, recommendations and any general comments.
- F. Finish recording data on test forms, completely filling in the blanks.
- G. Turn in 3 copies of report to engineer for approval.

END OF SECTION 260508

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## SECTION 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specification Section, apply to this Section.

#### 1.2 SUMMARY

- A. General: Provide 600 volt wire and cable in accordance with the Contract Documents.

#### 1.3 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
  - 1. Underwriters Laboratory Standard No. UL 467
    - a. ASTM
    - b. IPECA
  - 2. Terminal Blocks
    - a. UL-1059

### PART 2 - PRODUCTS

#### 2.1 WIRE AND CABLE

- A. General
  - 1. Provide wire with a minimum insulating rating of 600 volts, except for wire used in 50 volts or below applications for control of signal systems use 300 volt minimum or 600 volt where permitted to be incorporated with other wiring systems.
- B. Conductor
  - 1. Electrical grade, annealed copper fabricated in accordance with ASTM standards. Minimum size number 12 for branch circuits; number 14 for control wiring.
  - 2. The conductors shown on the drawings are copper, except as noted otherwise.
- C. Stranding and Number of Conductors
  - 1. Number 12 and number 10 solid.

2. Cables larger than number 10, stranded in accordance with ASTM Class B stranding designations.
3. Control wires stranded in accordance with ASTM Class B stranding designations.
4. Cables, multi-conductor unless otherwise noted for low tension systems.

D. Insulation

1. Type THWN/THHN insulation suitable for use in wet locations up to 75 degrees Centigrade. Use for lighting, receptacle and motor circuits and for panel and equipment feeders.
2. Type THHN – Flame retardant: Heat-resistant thermoplastic insulation, nylon jacket rated for 90 degrees Centigrade operation. Use for lighting branch circuit wiring installed and passing through the ballast channels of fluorescent fixtures, wiring in metal roofdecks in or near roof insulation, in attic or joist spaces, or in raceways exposed to the sun.
3. Type XF – Crosslinked polyolefin insulated heat-resistant wire suitable for 150 degrees Centigrade operation. Use for fixture wiring or any wiring within 3 feet horizontally or 10 feet above any furnace, boiler or similar appliance.

E. 2-Hour Fire Rated Wiring System (MI)

1. Cable shall be 2-hour rated, UL rated with copper sheath. Cable shall be factory assembled of one or more conductors insulated with highly compacted magnesium oxide insulation and enclosed in a seamless, liquid- and gas-tight continuous copper sheath.
2. Conductors shall be solid, high electrical conductivity copper with cross section corresponding to the standard N.E.C. AWG sizes.
3. Insulation shall be of highly compressed magnesium oxide that provided proper spacing for the conductors. Thickness of the insulation shall be at least 55 mils for all 600 volt power or control cables.
4. Cable and installation shall comply with N.E.C. Article 332. Cables must be supported per for manufacturers recommendations.
5. Cable shall be Pentair System 1850 or approved equal. Provide shop drawings of cable and fittings.

F. Color Coding

1. Provide consistent color coding of all feeders, sub feeders, motor circuits and the likes as follows:

120/208 Volts Code	277/480 Volts Code
Phase A - Black	Phase A - Brown
Phase B - Red	Phase B - Orange
Phase C - Blue	Phase C - Yellow
Neutral - White	Neutral - Gray
Ground - Green	Ground - Green w/Yellow Stripe

2. Color code wiring for control systems installed in conjunction with mechanical and/or miscellaneous equipment in accordance with the wiring diagrams furnished with the equipment. Factory color code wire number 2 and smaller. Wire number 1 and larger may be color coded by color taping of the entire length of the exposed ends.

## 2.2 CONNECTORS

- A. Make connections, splices, taps and joints with solderless devices, mechanically and electrically secure. Protect exposed wires and connecting devices with electrical tape or insulation to provide not less than that of the conductor.
- B. Branch Circuit wires (Number 10 and smaller): Use any of the following types of terminals and connecting devices:
  - 1. Hand Applied
    - a. Coiled tapered, spring wound devices with a conducting corrosion-resistant coating over the spring steel and a plastic cover and skirt providing full insulation for splice and wired ends. Screw connector on by hand.
  - 2. Tool Applied
    - a. Steel cap, with conduction and corrosion resistant metallic plating, open at both ends, fitted around the twisted ends of the wire and compressed or crimped by means of a special die designed for the purpose. Specifically fitted plastic or rubber insulating cover wrap over each connector.

## 2.3 ELECTRICAL TAPE

- A. Specifically designed for use as insulating tape.

## 2.4 LUBRICANT

- A. Use lubricant only where the possibility of damage to conductors exists. Use only a lubricant approved by the cable manufacturer and one which is inert to cable and raceways.

# PART 3 - EXECUTION

## 3.1 WIRE AND CABLE

- A. Provide a complete system of conductors in raceway system. Mount wiring through a specified raceway, regardless of voltage application.
- B. Drawings do not indicate size of branch circuit wiring. For branch circuits whose length from panel to furthest outlet exceeds 100 feet for 120-volt circuits, use number 10 or larger.
- C. Do not install wire in incomplete conduit runs nor until after the concrete work and plastering is completed and moisture is swabbed from conduits. Eliminate splices wherever possible. Where necessary, splice in readily accessible pull, junction, or outlet.
- D. Provide cable supports for all vertical risers where required by code.

- E. Flashover or insulation value of joints to be equal to that of the conductor. Provide Underwriters Laboratories listed connectors rated at 600 volts for general use and 1,000 volts for use between ballasts and lamps or gaseous discharge fixtures.
- F. Use terminating fittings, connectors, etc., of a type suitable for the specified cable furnished. Make bends in cable at termination prior to installing compression device. Make fittings tight.
- G. Extend wire sizing for the entire length of a circuit, feeder, etc. unless specifically noted otherwise.
- H. Provide a separate neutral conductor for each branch circuit. In the event a common neutral conductor is used, such as in furniture systems, the circuit breaker in the panelboard must be common trip for each phase that uses one neutral conductor.

END OF SECTION 260519

## SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specification Section, apply to this Section.

#### 1.2 SUMMARY

- A. General: Provide a low impedance grounding system in accordance with the Contract Documents.

#### 1.3 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
  - 1. Underwriters Laboratory Standard No. UL 467
  - 2. ANSI C-1 1978

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Furnish and install an electrical grounding system as indicated on the construction documents and as specified herein.
- B. Grounding systems shall be installed in accordance with the requirements of the local authorities, NEC Section 250, and subject to the approval of the Architect.
- C. All ground wires and bonding jumpers shall be stranded copper installed in conduit. All ground wires shall be without joints and splices over its entire length.

#### 2.2 GROUNDING SYSTEMS

- A. The system neutral shall be grounded at the service entrance only and kept isolated from grounding systems throughout the building.
- B. Each system of continuous metallic piping and ductwork shall be grounded in accordance with the requirements of the NEC Section 250.

- C. Metal conduits and portions of metallic piping and duct systems which are isolated by flexible connections, insulated coupling, etc., shall be bonded to the equipment ground with a flexible bonding jumper, or separate grounding conductor.
- D. All conduits, metal raceways, boxes, cabinets, etc., installed by this Contractor and all motors and equipment connected shall be properly bonded and grounded.
- E. In all feeders and branch circuits install a green colored ground wire to each panel, cabinet, receptacle, motor or a piece of control equipment.
- F. The green ground wires shall be extended and connected to the ground bus in the panels or equipment enclosure. Neutral wiring system shall not be used for this purpose. Green ground wire shall be connected to all junction or pull boxes through which they pass and to all cabinet and panel enclosures.
- G. This ground wire shall be run in same conduit as phase and neutral wires feeding equipment, motor or receptacles and conduit size shall be increased if necessary. This conductor shall be installed whether or not shown on the drawings and shall be sized in accordance with NEC but shall not be smaller than #12 AWG. Motors shall be grounded by a grounding terminal in their connection box. Tie all ground wires together in panels and connect to ground bus in panel cabinet.
- H. All electrical equipment including lighting fixtures shall be grounded in the same manner as motors. All equipment shall be solidly grounded to the green covered wire and this Contractor shall furnish grounding lugs as required.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Grounding connections and splices shall be brazed molded exothermic welded, bolted clamp terminal or pressure-connector type. Bolted connections and pressure-connectors shall be used for connections to removable equipment. Brazed connections shall be made where noted on drawings.

END OF SECTION 260526



## SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specification Section, apply to this Section.

#### 1.2 SUMMARY

- A. Equipment shall be installed on hangers and supports as specified in this section of the specifications.

#### 1.3 SUPPORTS

- A. Support work in accordance with the best industry practice and the following.
- B. Include supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets.
- C. Include supporting frames or racks for equipment, intended for vertical surface mounting, which is required in a free-standing position.
- D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members. They shall be rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.
- E. Nothing, (including outlet, pull and junction boxes and fittings) shall depend on electric conduits, raceways, or cables for support, except that threaded hub type fittings having a gross volume not in excess of 100 cubic inches may be supported from heavy wall conduit, where the conduit in turn is securely supported from the structure within five inches of the fitting on two opposite sides.
- F. Nothing shall rest on, or depend for support on, suspended ceilings media (tiles, lath, plaster, as well as splines, runners, bars and the like in the plane of the ceiling).
- G. Provide required supports and hangers for conduit, equipment, etc., so that loading will not exceed allowable loadings of structure.

#### 1.4 FASTENINGS

- A. Fasten electric work to building structure in accordance with the best industry practice and the following:
- B. As a minimum procedure, where weight applied to the attachment points is 100 pounds or less, fasten to building elements of:
  - 1. Wood – with wood screws.
  - 2. Concrete and solid masonry – with bolts and expansion shields.
  - 3. Hollow Construction – with toggle bolts.
  - 4. Solid metal – with machine screws in tapped holes or with welded studs.
  - 5. Steel decking or subfloor – with fastenings as specified below for applied weights in excess of 100 pounds.
- C. As a minimum procedure, where weight applied to the attachment points exceeds 100 pounds, but is 300 pounds or less, conform to the following:
  - 1. At concrete slabs utilize 24" x 24" x 1/2" steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top of slab screen line, where no fill is to be applied.
  - 2. At steel decking or subfloor for all fastenings, utilize through bolts or threaded rods. The tops of bolts or rods shall be set at least one inch below the top fill screen line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or subfloor manufacturer produces specialty hangers to work with his decking or subfloor such hangers shall be utilized.
- D. Where weight applied to building attachments points exceeds 300 pounds, coordinate with and obtain approval of Architect and conform to the following:
  - 1. Utilize suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Utilize threaded rods or bolts to attach to bridging members.
- E. Floor mounted equipment shall not be held in place solely by its own dead weight. Include floor anchor fastenings in all cases.
- F. For items which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.

END OF SECTION 260529

## SECTION 260533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. General: Provide raceways in accordance with the Contract Documents.

#### 1.2 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:

1. Rigid Conduit – RMC
  - a. UL Standard UL-6
  - b. ANSI C80-1
  - c. Federal Specification WW-C-581E
2. Electrical Metallic Tubing – EMT
  - a. UL Standard UL-797
  - b. ANSI C80-3
  - c. Federal Specification WW-C-563
3. Flexible Metal Conduit – FMC
  - a. UL Standard UL-1
4. LiquidTight Flexible Metal Conduit – LFMC
  - a. UL Standard UL-360
5. Rigid Non-Metallic Conduit – RNC
  - a. UL Standard UL-651
  - b. ANSI Standard C33.91
  - c. Federal Specifications GSA-FSS and W-C1094-A
6. Wireways and Auxiliary Gutters
  - a. UL Standard UL-870
7. Metal Clad Cable – MC
  - a. UL Standard 1581
  - b. Federal Spec J-C-30B

## PART 2 - PRODUCTS

### 2.1 RACEWAY TYPES

#### A. Rigid Steel Conduit – RMC

1. Rigid steel conduit heavy wall galvanized.

#### B. Electric Metallic Tubing – EMT

1. Continuous, seamless tubing galvanized or sheradized on the exterior coated on the interior with a smooth hard finish of lacquer, varnish or enamel.
2. All couplings, connectors, etc., used in conjunction with this raceway which are 2 inch in size and smaller shall be watertight compression type. EMT fittings shall be malleable iron zinc coated. With conduits of 2-1/2 inch in size and larger, set screw type couplings are permitted.

#### C. Flexible Metal Conduit – FMC

1. Single strip, continuous, flexible interlocked double-wrapped steel, galvanized inside and outside forming smooth internal wiring channel.
2. Maximum length: 6 feet.
3. Each section of raceway must contain a bonding wire bonded at each end and sized as required. Provide connectors with insulating bushings.

#### D. LiquidTight Flexible Metal Conduit – LFMC

1. Same as flexible steel conduit except with tough, inert watertight plastic outer jacket.
2. Cast malleable iron body and gland nut cadmium plated with one-piece brass grounding bushings which thread to interior of conduit. Spiral molded vinyl sealing ring between gland nut and busing and nylon insulated throat.

#### E. Metal Clad Cable – MC

##### Non Health Care

1. Type MC cable shall be armored galvanized steel sheath cable with copper conductors and THHN 90 ° insulation. Furnish with insulated grounding conductor.

#### F. Rigid Non-Metallic Conduit – RNC

1. Composed of polyvinyl chloride suitable for 90° C.
2. Raceway, fittings and cement must be produced by the same manufacturer who must have had a minimum of ten (10) years experience in manufacturing the products.
3. Materials must have a tensile strength of 7,000 – 7,200 psi and compressive strength of 9,000 psi.
4. All joints shall be solvent cemented in accordance with the recommendations of the manufacturer. Install expansion fittings per NEC.

#### G. Wireways and Auxiliary Gutters

1. Of sizes and shapes indicated on the Drawings and as required.
2. Provide all necessary elbows, tees, connectors, adaptors, etc.
3. Hinged cover secured with captive screws.
4. Wire retainers not less than 12 inches on center.

H. Duct Banks

1. Provide duct banks as indicated on the Drawings.
2. Reinforce duct banks with steel where such duct banks are positioned beneath roads and parking areas.
3. Concrete to be minimum of 3,000 pounds per square inch.
4. Provide rigid steel raceway across all excavated and backfilled ditches and for a length of 10 feet from building and manhole walls. Pitch conduit away from building at every point where duct bank enters the building or equipment.
5. Support raceways installed in duct banks every 5 feet to assure correct alignment prior to placing concrete.
6. Terminate raceways with flared bells to enable ease of pulling cable and to eliminate stress on the cable. Free bells and raceway terminations of burrs and rough edges.
7. Provide concrete markers at grade where duct banks are stubbed out for future use.
8. Install duct banks not less than 30 inches below grade. Install 6 inch marking ribbon 12 inches below grade.

2.2 OUTLET, JUNCTION AND PULLBOXES

- A. Provide zinc-coated or cadmium-plated sheet steel outlet boxes not less than 4 inches octagonal or square, unless otherwise noted. Equip fixture outlet boxes with 3/8 inch no-bolt fixture studs where required. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture. Fit outlet boxes in finished ceilings or walls with appropriate covers, set flush with the finished surface. Where more than one switch or device is located at one point, use gang boxes and covers unless otherwise indicated. Sectional switch boxes or utility boxes will not be permitted. Provide Series "GW" (Steel City) tile box, or as accepted, or a 4 inch square box with tile ring in masonry walls which will not be plastered or furred. Where drywall material is utilized, provide plaster ring. Provide outlet boxes of the type and size suitable for the specific application. Where outlet boxes contain two or more 277 volt devices, or where devices occur of different applied voltages, or where normal and emergency devices occur in same box, provide suitable barrier.
- B. Construct junction or pullboxes not over 150 cubic inches in size as standard outlet boxes, and those over 150 cubic inches the same as "cabinets" with screw covers of the same gauge metal.
- C. Plug any open knockouts not utilized.
- D. Provide surface mounted outlet and junction boxes in indoor locations where exposed to moisture and outdoor locations of cast metal with threaded hubs.

## PART 3 - EXECUTION

### 3.1 APPLICATION OF RACEWAYS

- A. The following applications must be adhered to except as otherwise required by Code. Raceway not conforming to this listing must be removed by this Contractor and replaced with the specified material at this Contractor's expense.

B. Raceway Types Application

Rigid Conduit RMC	1. Where exposed on outside of building or subjected to exterior temperatures and humidity. 2. Where required by codes. 3. All circuits in excess of 600V.
Electrical Metallic Tubing EMT	Use in every instance except where another material is specified.
Flexible Metal Conduit – FMC	Use in dry areas for connections to lighting fixtures in hung ceilings, connections to equipment installed in removable panels of hung ceilings at all transformer or equipment raceway connections where sound and vibration isolation is required.
LiquidTight Flexible Metal Conduit - LFMC	Use in areas subject to moisture where flexible steel is unacceptable at connections to all motors, and all raised floor areas.
Rigid Non-Metallic Conduit – RNC	1. Schedule 40 – Where raceways are in slab in below grade levels, for raceway duct banks. 2. Schedule 80 – For underground raceways outside of the building which are not encased in concrete
Metal-Clad Cable - MC	Use for branch circuit wiring above suspended ceilings or in metal stud walls. Cable shall not be run exposed. Home run wiring from panelboard to first outlet box shall be installed in conduit. MC cable not permitted for fire alarm wiring systems or emergency lighting.
Wireways and Auxiliary Gutters	Where indicated on the drawings and as otherwise specifically approved.

### 3.2 RACEWAY SYSTEMS IN GENERAL

- A. Provide raceways for all wiring systems unless noted otherwise. 277/480 volt wiring must be kept independent of 120/208 volt wiring. Where non-metallic raceways are utilized, provide sizes as required with the grounding conductor considered as an insulated additional conductor. Minimum size 3/4 inch for home runs and 1 inch minimum for power distribution. Wiring of each type and system must be installed in separate raceways.
- B. Install capped bushings on raceways as soon as installed and remove only when wires are pulled. Securely tie embedded raceway in place prior to embedment. Raceways installed below or in floor slabs must extend a minimum of 4 inches above the finished slab to the first connector. Lay out the work in advance to avoid excessive concentrations or multiple raceway runs.

- C. Locate raceways so that the strength of structural members is unaffected, and they do not conflict with the services of other trades. Install 1 inch or larger raceways in or through structural members (beams, slabs, etc.) only when and in the manner accepted by the Architect. Draw up couplings and fittings full and tight. Protect threads from corrosion with one coat zinc chromate after installation.
- D. Above Grade – Defined as the area above finished grade for a building exterior and above top surface of any slabs (or other concrete work) on grade for a building interior. Above-grade raceways to comply with the following:
1. Install raceways concealed except at surface cabinets and for motor and equipment connection in electrical and mechanical rooms. Install a minimum of 6 inches from flues, steam pipes, or other heated lines. Provide flashing and counter-flashing for waterproofing of raceways, outlets, fittings, etc., which penetrate the roof. Route raceways parallel or perpendicular to building lines with right-angle turns and symmetrical bends. Run embedded raceways in a direct line and, where possible, with long sweep bends and offsets. Provide sleeves in forms for new concrete walls, floor slabs and partitions for passage of raceways. Waterproof sleeved raceways where required.
  2. Provide raceway expansion joints for exposed and concealed raceways with necessary bonding conductor at building expansion joints and between buildings or structures and where required to compensate for raceway or building thermal expansion and contraction.
  3. Provide one empty 3/4 inch raceway for each three spare unused poles or spaces of each flush-mounted panelboard. Terminate empty 3/4 inch conduit in a junction box, which after completion, is accessible to facilitate future branch circuit extension.
  4. Provide raceway installation (with appropriate seal-offs, explosion-proof fittings, etc.) in special occupancy area, as required. Provide conduit seal-offs where portions of an interior raceway system pass through walls, ceiling or floors which separate adjacent rooms having substantially different maintained temperatures, as in refrigeration or cold storage rooms.
  5. Protect raceway in earth or fill with two coats of asphalt base paint. Touch up abrasions and wrench marks after conduit is in place.
  6. In lieu of above, protect raceways with a minimum of 20 mil tape approved for the purpose and overlapped a minimum of 1/2 tape width.
  7. Provide drag wire in spare or empty raceways. Tag both ends of wire denoting opposite and termination location with black India ink on flameproof linen tag.
- E. Below Grade: Defined as the area below finished grade for a building exterior and below or within the bottom floor slab for a building interior. Below grade raceways to comply to the following.
1. Project below-grade raceways 2 inches minimum above floor or equipment foundation. Install exterior underground conduits 24 inches minimum below finished grade. Do not penetrate waterproof membranes unless proper seal is provided.
- F. No raceway may be installed in a concrete slab except with the permission of the Structural Engineer and with the written consent of the Owner. Conduits embedded in structural concrete slabs shall have the following minimum thickness and shall conform to the following:

Raceway Sizes	Minimum Thickness of Concrete Slab
3/4"	4 - 1/2"
1"	5"

1. Unless specifically approved in writing, raceways 1-1/4 inch size and larger shall not be installed in structural concrete slabs.
2. In no case will installation of raceways be permitted to interfere with the proper placement of principal reinforcement.
3. Raceways in structural slabs shall be placed between the upper and the lower layers of reinforcing steel. This will require careful bending of conduits.
4. Raceways embedded in concrete slabs shall be spaced not less than 8 inches on centers and as widely spaced as possible where they converge at panels or junction boxes.
5. Raceways running parallel to slab supports, such as beams, columns and structural walls, shall be installed not less than 12 inches from such supporting elements.
6. To prevent displacement during concrete pour of lift slab, saddle supports for conduit, outlet boxes, junction boxes, inserts, etc., shall be secured with suitable adhesives.

G. Rigid non-metallic conduit installations shall conform to the following:

1. All joints are to be made by the solvent cementing method using the material recommended by the raceway manufacturer. Fittings, cement and conduit shall be supplied by the same manufacturer.
2. Raceway cutoffs shall be square and made by handsaw or other approved means which does not deform the conduit. Raceway shall be reamed prior to solvent cementing to couplings, adapters, or fittings.
3. Electrical devices which are served by PVC raceways to be grounded by means of ground wire pulled in the raceway.
4. Male box adapters shall be used for all box or raceway fittings to terminate plastic raceways.
5. Where separable terminations are required, they shall be made using PVC threaded adapters with locknuts or bushings. If such terminations must be watertight, "O" rings shall be installed.
6. Bends shall be made by methods that do not deform or damage the conduit. The radii of field bends shall not be less than those established by the NEC.
7. Raceway expansion fittings shall be provided in accordance with NEC. The position of the expansion fitting shall be adjusted proportional to the temperature at installation.
8. Raceway supports shall be installed in such a manner to allow the PVC conduit to slide through the supports as the temperature changes.
9. Elbows must be galvanized rigid steel.
10. Rigid non-metallic conduit is not permitted to be installed within the building.

H. Raceways in hung ceilings shall be run on and secured to slab or primary structural members of ceiling, not to lathing channels or T-bars or other elements which are the direct supports of the ceiling panels. Secure conduit firmly to steel by clips and fittings designed for that purpose. Install as high as possible, but not less than, 1-0" above hung ceilings.



- I. Exposed raceways shall be run parallel or at right angles with building lines. Secure raceway clamps or supports to masonry materials by toggle bolts, expansion bolts, or steel inserts. Install raceway on steel construction with approved clamps which do not depend on friction or set-screw pressure alone.
- J. Clear raceway of all obstructions and dirt prior to pulling in wires or cables. This shall be done with ball mandrel (diameter approximately 85% of conduit inside diameter) followed by close fitting wire brush and wad of felt or similar material. This assembly may be pulled in together with, but ahead of the cable being installed. All empty raceways shall be similarly cleaned. Clear any raceway which rejects ball mandrel.
- K. Support less than 2 inch trade size, vertically run, raceways at intervals no greater than eight feet. Support such raceways, 2 inch trade size or larger, at intervals no greater than 10 feet.
- L. Support less than 1 inch trade size horizontally run, raceways at intervals not greater than 7 feet. Support such raceways, 1 inch trade size or larger, at intervals no greater than 10 feet.

### 3.3 WIREWAY AND AUXILIARY GUTTER

- A. Wireways installed in hung ceilings shall be placed such that the cover will hinge upward from the side.
- B. A 12 inch clear work space shall be provided from wireway cover when it is in the open position.

### 3.4 OUTLET, JUNCTION, AND PULLBOXES

- A. Provide outlet, junction, and pullboxes as indicated on the Drawings and as required for the complete installation of the various electrical systems, and to facilitate proper pulling of wires and cables. J-boxes and pullboxes shall be sized per NEC minimum.
- B. The exact location of outlets and equipment is governed by structural conditions and obstructions or other equipment items. When necessary, relocate outlets so that when fixtures or equipment are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment. Verify final location of outlets, panels equipment, etc., with Architect.
- C. Back-to-back outlets in the same wall or "thru-wall" type boxes are not permitted. Provide 12 inch (minimum) spacing for outlets shown on opposite sides of a common wall to minimize sound transmission.

### 3.5 FLOOR BOXES

- A. Reference shall be made to other sections of this specification for floor boxes.

END OF SECTION 260533

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## SECTION 260536 – CABLE TRAYS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes steel wire basket runways, and aluminum ladder tray, and accessories. Ladder tray shall be installed where noted on plans. All references to wire basket runway shall also apply to ladder tray.
- B. Related Sections include the following:
  - 1. Furnish and install firestopping materials thru penetrations at walls, ceilings, and other fire-rated elements.
  - 2. Division 26 Section "Electrical General Provisions" for wire basket runway supports not specified in this Section.

#### 1.3 SUBMITTALS

- A. General: Submit wire basket runway and ladder tray as herein specified.
- B. Product Data: Include data indicating dimensions and finishes for each type of wire basket runway and cable tray indicated.
- C. Shop Drawings: For each type of wire basket runway and cable tray.
  - 1. Show fabrication and installation details of wire basket runway, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
- D. Coordination Drawings: Floor plans and sections drawn to scale. Include scaled wire basket runway layout and relationships between components and adjacent structural and mechanical elements. Show the following:
  - 1. Vertical and horizontal offsets and transitions.
  - 2. Clearances for access above and to side of wire basket runways.
  - 3. Vertical elevation of wire basket runways above floor or bottom of ceiling structure.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA VE 1, "Wire Basket Runway Systems," if wire basket runway types specified are defined in the standard.
- C. Comply with NFPA 70.

#### 1.5 COORDINATION

- A. Coordinate layout and installation of wire basket runways and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
  - 1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect without any additional cost to the Owner.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cablofil
  - 2. Flextray
  - 3. Hubbel-Premise
  - 4. Mono-Systems

#### 2.2 MATERIALS AND FINISHES

- A. Wire Mesh Cable Tray
  - 1. Carbon steel ASTM A 510, Grade 1008. Wire welded, bent and surface treated after manufactured.
  - 2. Cable tray finish shall be:
    - a. Electrodeposited zinc plating ASTM B633 Type III SC-1. Plate mesh after welding and bending of mesh.
    - b. Cable tray shall a continuous Safe-T edge T-welded to top side to protect cable insulation. Provide splices, supports, hangers and other fittings for a complete installation.
    - c. Support with trapeze hangers unless otherwise noted on the drawings.
- B. Ladder Cable Tray

1. Ladder tray shall be constructed of 6063 T6 aluminum alloy.
2. Tray shall be constructed with two components side rail and rungs. The side rails shall be a single aluminum extrusion with extending flanges that support the rungs.
3. Rungs shall have a 7/8" cable laying surface spaced 6" centers. Provide all fittings and accessories for a complete installation.

## 2.3 WIRE BASKET RUNWAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as the wire basket runway.
- B. Wire basket runway supports and connectors, including bonding jumpers, shall be as recommended by manufacturer.

## 2.4 WARNING SIGNS

- A. Lettering: 1-1/2-inch high, black letters on yellow background with legend "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."

## 2.5 CABLE TRAY GROUNDING

- A. Install a continuous #6 AWG bare grounding wire in cable tray and attach to tray on 10' centers with approved grounding clamp. Connect grounding wire to ground bus in I.T. Room or as directed by the Engineer.

# PART 3 - PRODUCTS

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 WIRE BASKET RUNWAY INSTALLATION

- A. Install wire basket runway level and plumb according to manufacturer's written instructions, rough-in drawings, as shown on drawings, and referenced standards.
- B. Remove burrs and sharp edges from wire basket runway.

- C. Fasten wire basket runway supports securely to building structure as specified in Division 26 Section 260529 "Hangers and Supports for Electrical Systems," unless otherwise indicated.
  - 1. Locate and install supports according to NEMA VE 1.
- D. Make connections to equipment with flanged fittings fastened to wire basket runway and to equipment. Support wire basket runway independently of fittings. Do not carry weight of wire basket runway on equipment enclosure.
- E. Install expansion connectors where wire basket runway crosses building expansion joint and in wire basket runway runs that exceed 90 feet. Space connectors and set gaps according to NEMA VE 1.
- F. Make changes in direction and elevation as required using standard fittings at no additional cost to the Owner.
- G. Make wire basket runway connections using standard fittings.
- H. Locate wire basket runway above piping as required for tray accessibility and as coordinated in the field.
- I. Seal penetrations through fire and smoke barriers after cables are installed.
- J. Sleeves for Future Cables: Install capped sleeves for future cables through firestop-sealed wire basket runway penetrations of fire and smoke barriers.
- K. Workspace: Install wire basket runways with sufficient space to permit access for installing cables.
- L. After installation of wire basket runways is completed, install warning signs in visible locations on or near cable trays.
- M. Provide hangers within 24" from end of tray and distance between hangers shall not exceed 72".
- N. Cable/ladder tray is to be utilized for low voltage cabling only.

### 3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.4 FIELD QUALITY CONTROL

- A. Testing
  - 1. Grounding: Test wire basket runways to ensure electrical continuity of bonding and grounding connections.

2. Anchorage: Test pull-out resistance of one of each type, size, and anchorage material for toggle bolts and power driven threaded studs.
  - a. Furnish equipment, including jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain Architect approval before transmitting loads to the structure. Test to 90% of rated proof load for fastener.
3. Correct malfunctioning units at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

B. Inspections

1. Visual inspection of the Wire Basket Runway System must be performed prior to any installation of cables.

END OF SECTION 260536

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## SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Condition and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Identification for electrical raceways
  - 2. Identification of power and control cables
  - 3. Identification for branch circuit and feeder conductors
  - 4. Warning labels and signs per N.E.C.
  - 5. Instruction signs
  - 6. Identification labels for distribution equipment, junction boxes, cabinets and miscellaneous equipment.

#### 1.3 SUBMITTALS

- A. Product Data: Furnish type of material to be supplied for each electrical identification product indicated.

#### 1.4 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
  - 1. Comply with ANSI A13.1
  - 2. Comply with NFPA 70
  - 3. Comply with 29 CFR 1910.144 and 29 CFR 1910.145
  - 4. Comply with ANSI Z535.4 for safety signs and labels

#### 1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors and features with requirements in the Contract Documents, shop drawings, manufacturer's wiring diagrams and operation and manual and with those required by codes and standards.

### PART 2 - PRODUCTS

2.1 POWER RACEWAY AND METAL CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Raceway Colors for Circuits at 600 V or Less
  - 1. Black letters on an orange field.
  - 2. Fire Alarm Circuits: Red letters on natural field.
  - 3. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.4 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
  - 1. Engraved legend with black letters on white face.
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.5 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

## 2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 90A: Identify with orange self-adhesive vinyl label.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands.
  - 1. Fire Alarm System: Red
  - 2. Fire-Suppression Supervisory and Control System: Red and Yellow
  - 3. Combined Fire Alarm and Security System: Red and Blue
  - 4. Security System: Blue and Yellow
  - 5. Mechanical and Electrical Supervisory System: Green and Blue
  - 6. Telecommunication System: Green and Yellow
  - 7. Control Wiring: Green and Red
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels with mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

## 3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
  - 1. Emergency Power
  - 2. Power

3. UPS
  - B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
    1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
      - a. Colors for 208/120-V Circuits
        - 1) Phase A: Black
        - 2) Phase B: Red
        - 3) Phase C: Blue
        - 4) Neutral: White
        - 5) Ground: Green
      - b. Colors for 480/277-V Circuits
        - 1) Phase A: Brown
        - 2) Phase B: Orange
        - 3) Phase C: Yellow
        - 4) Neutral: White
        - 5) Ground: Green
      - c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
  - C. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
  - D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
    1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
    2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
    3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
  - E. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install marking tape at flush-mounted panelboards and similar equipment in finished spaces.
  - F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
    1. Comply with 29 CFR 1910.145.
    2. Identify system voltage with black letters on an orange background.
    3. Apply to exterior of door, cover, or other access.

4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
  - a. Power transfer switches.
  - b. Controls with external control power connections.
- G. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- H. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
  1. Labeling Instructions
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide five lines of text.
      - 1) First Line: 1/2-inch letters on the first line stating equipment name.
      - 2) Second Line (if applicable): 3/8-inch letters stating the existing equipment name in parentheses ( ).
      - 3) Third Line: 3/8-inch letters stating voltage/phase.
      - 4) Fourth Line: 3/8-inch letters stating the breaker number, panel name and room number/name (Owner's room number) from which the equipment is fed.
      - 5) Fifth Line: 3/8-inch letters stating function and/or equipment which it controls.
  2. Equipment to be Labeled
    - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
    - b. Enclosures and electrical cabinets.
    - c. Access doors and panels for concealed electrical items.
    - d. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    - e. Emergency system boxes and enclosures.
    - f. Enclosed switches.
    - g. Enclosed circuit breakers.
    - h. Remote-controlled switches, dimmer modules, and control devices.
    - i. Battery-invert units.
    - j. Monitoring and control equipment.
    - k. UPS equipment.

END OF SECTION 260553

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SECTION 260572 - SHORT CIRCUIT, COMPONENT PROTECTION, FLASH HAZARD  
AND SELECTIVE COORDINATION STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide a short-circuit, component protection, flash hazard analysis, and selective coordination study for the electrical distribution system from all power sources (normal and emergency) down to the branch circuit overcurrent protective device and equipment. The short circuit, selective coordination and flash hazard study shall be performed by the manufacturer supplying the equipment. Series rated systems are not approved.

1.2 PURPOSE

- A. The study shall calculate the available short-circuit current at each point in the electrical distribution system. The overcurrent protective devices shall have an interrupting rating equal to or greater than the available short-circuit current at the point of application.
- B. The study shall examine proper protection of electrical system components and utilization equipment such that the equipment has a sufficient short-circuit current rating. If a specific type of overcurrent protective device is required for proper protection of equipment, it shall be noted in the report and reflected in the design of the system.
- C. The study shall include a flash hazard analysis for electrical distribution equipment. The analysis shall determine the flash protection boundary, incident energy, and required level of personal protective equipment (PPE) for workers at the electrical distribution equipment. The flash protection boundary and incident energy shall be determined based upon a working distance of 18 inches. The electrical distribution equipment shall be field marked with this information in accordance with codes and standards.
- D. The overcurrent protective devices shall be analyzed for selective coordination. This analysis shall identify any potential selective coordination problems up the available short-circuit current. Any areas where the overcurrent protective devices are not selectively coordinated shall be explicitly noted and recommendations shall be made to achieve selective coordination if desired.
- E. The studies shall be submitted to the Design Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Engineer may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.

- F. The studies shall include all portions of the electrical distribution system from the normal power source or sources down to and including the smallest adjustable trip circuit breaker in the distribution system. Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.
- G. The firm should be currently involved in high and low-voltage power system evaluation. The study shall be performed, stamped and signed by a registered professional engineer. Credentials of the individual performing the study and background of the firm shall be submitted to the Engineer for approval prior to start of the work. A minimum of five (5) years experience in power system analysis is required for the individual in charge of the project.
- H. The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.

### 1.3 REFERENCES

- A. The study shall be completed in accordance with the latest edition of IEEE Standard 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
- B. The flash hazard analysis shall be completed in accordance with latest editions of NFPA 70E – Standard for Electrical Safety Requirements for Employee Workplaces and IEEE Standard 1584 – Guide for Performing Arc-Flash Hazard Calculations.

### 1.4 DATA COLLECTION FOR THE STUDY

- A. The Contractor shall provide the required data for preparation of the studies. The Engineer performing the system studies shall furnish the Contractor with a listing of the required data immediately after award of the contract.
- B. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacturing.

### 1.5 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION AND COORDINATION STUDY

- A. The short-circuit study shall be performed with the aid of a digital computer program and shall be in accordance with the latest applicable IEEE and ANSI standards.



- B. In the short-circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions, and recommendations. Calculate short-circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low-voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant overcurrent protective device locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor fault contribution, short circuit kVA, and symmetrical and asymmetrical fault currents.
- C. In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
- D. Include on the curve sheets power company relay and fuse characteristics, medium-voltage equipment protective relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. In addition, include all devices down to the largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical fault current to which the device is exposed.

- E. Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristics curves from curves for other devices by at least a 0.4-second time margin.
- F. Include complete fault calculations as specified herein based on contract documents.
- G. Submit qualifications of individual(s) who will perform the work for approval prior to commencement of the studies. Provide studies in conjunction with equipment submittals to verify equipment ratings required. Submit the study to Engineer for review prior to delivery of the study to the Owner. Make all additions or changes as required by the reviewer.
- H. Contractor shall furnish all data as required by the short-circuit/coordination study vendor. Utilize data for the study obtained by the Contractor from contract documents, including contract addendums issued prior to bid openings.

- I. Notify the Engineer in writing of circuit protective devices not properly rated for fault conditions.
- J. Mechanical Contractor to provide settings for the packaged chiller and/or motor starters.
- K. When emergency generator is provided, include phase and ground coordination of the generator protective devices. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Contractor shall obtain the information from the generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.

#### 1.6 SUBMITTALS

- A. The results of the study shall be summarized in report form. Submit 6 copies for review and approval by the design engineer.
- B. The results of the study shall include the following:
  - 1. Descriptions, purpose, basis, and scope of study.
  - 2. Fault current calculations including definition of terms and guide for interpretation of computer printout.
  - 3. Tabulations of protective device and equipment ratings versus calculated short-circuit duties, and commentary regarding same.
  - 4. Flash hazard analysis report for electrical distribution equipment.
  - 5. Time versus current curves or fuse selectivity ratio analysis, with tabulations of overcurrent protective device settings, and selective coordination analysis and commentary regarding same.
- C. If power company review and approval is required, the results of the study shall be submitted to the power company for review and approval. Approved copies from the power company shall be forwarded to the design engineer.

#### 1.7 SUBMITTALS – CLOSEOUT

- A. Submit 6 copies of the final approved study to the electrical design engineer.

### PART 2 - PRODUCTS

#### 2.1 REQUIREMENTS

- A. The short circuit and flash hazard analysis study shall be completed with the aid of a computer software program where possible.
- B. The available short-circuit current, corresponding required interrupting or short-circuit current ratings of components, and flash hazard analysis data, shall be calculated based upon the 3-phase bolted short-circuit, current and phase to ground/neutral short-circuit current at each of the following (if applicable):

1. Utility Service Point.
2. Medium voltage switchgear.
3. Medium voltage motor controllers.
4. Medium/Low-Voltage Unit Substations.
5. Low-voltage switchgear or switchboards.
6. Distribution panelboards.
7. Branch circuit panelboards.
8. Motor control centers.
9. Busway and Busplugs.
10. Other significant equipment or utilization equipment.

C. The study shall include the following:

1. Calculation methods and assumptions.
2. One-line diagram (with available short-circuit current and flash hazard data identified).
3. Calculations shall identify:
  - a. Available short-circuit currents from all power sources (kVA).
  - b. Motor fault contribution.
  - c. Component impedance data.
  - d. X to R ratio.
  - e. Symmetrical and asymmetrical fault current characteristics.
  - f. Flash hazard analysis data.
  - g. Tabulation of all calculation quantities and results.
4. Detailed description of each protective device identifying its type, function, manufacturer, interrupting rating, ampere rating, selected settings, and time-current characteristics.
5. System component characteristic curves or short-circuit current ratings identified and/or plotted up to the maximum symmetrical fault current to which the component is exposed. Include the following where applicable:
  - a. Medium voltage equipment characteristics.
  - b. Low voltage equipment characteristics.
  - c. ICEA conductor damage characteristics.
  - d. Transformer characteristics.
  - e. Motor and motor circuit equipment characteristics.
  - f. Generator and transfer switch (manual or automatic) characteristics.
  - g. Other system equipment characteristics.
6. Time-current curves prepared graphically on full size, log-log forms with title, one-line diagram, and specific system components analyzed.
7. Conclusions regarding interrupting rating for overcurrent protective devices, flash hazard analysis, protection of components, selective coordination, and recommendations and requirements on the same.

2.2 LABELS

- A. Arc flash and shock hazard labels shall be provided and installed on all equipment in the report noting the appropriate PPE required. Submit sample label for approval. A sample label format is available from the Engineer.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study, and protective device coordination study.
- B. Necessary field settings of devices, adjustments, and minor modifications to equipment to accomplish conformance with the approved short-circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the Owner.

**END OF SECTION 260572**

## SECTION 260800 - COMMISSIONING OF ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. The intent of this section is to specify the involvement Division 26 has in the commissioning process
  - 1. Commissioning is the joint responsibility of the Contractor (Including Subcontractors and Vendors) and the Commissioning Agent. This section is intended to provide an indication of the work that will be performed by the Contractor prior to verification by the Owner's Representative and the Commissioning Agent. The commissioning process requires Division 26 participation in order to ensure all portions of the work have been completed and are operating as intended.

#### 1.2 WORK OF DIVISION 26 INCLUDES

- A. Start-up and testing of the equipment.
- B. Assistance in testing, adjusting and balancing.
- C. Operating equipment and systems as required for commissioning tests.
- D. Provide equipment, materials and labor necessary to correct deficiencies found during the commissioning process, which fulfill contract and warranty requirements.
- E. Provide operation and maintenance information and as-built drawings to the Commissioning Agent for verification, organization and distribution.
- F. Provide assistance to the Commissioning Agent to develop and edit system operation descriptions.
- G. Provide training for the systems specified as required elsewhere in Division 26 with coordination by the Owner's Representative and Commissioning Agent.

#### 1.3 RELATED WORK

- A. All start-up and testing procedures and documentation requirements specified within Division 26.
- B. Section 019113 commissioning procedures that require participation of Division 26.
- C. Cooperate with the electrical testing company (ETC) in the following manner:
  - 1. Allow sufficient time before final commissioning dates so that testing, adjusting and balancing can be accomplished.

2. Provide labor and material to make corrections when required, without delay.

## PART 2 - PRODUCTS

### 2.1 TEST EQUIPMENT-PROPIETARY

- A. Proprietary test equipment required by the Manufacturer, whether specified or not, shall be provided by the Manufacturer of the equipment. The Manufacturer shall provide the test equipment, demonstrate its use and assist the Commissioning Agent in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.

## PART 3 - EXECUTION

### 3.1 WORK PRIOR TO COMMISSIONING

- A. Complete all phases of work so the system can be started, tested and adjusted before commissioned. The Electrical Contractor has primary start-up responsibilities with obligation to complete systems, including all sub-systems so they are fully functional. This includes the complete installation of all equipment, materials, wire, insulation, controls, etc. per the contract documents and related directives, clarification, change orders, etc.
- B. A commissioning plan will be developed by the Commissioning Agent. Division 26 is obligated to assist the Commissioning Agent in preparing the commissioning plan by providing all necessary information pertaining to the actual installation. If system modifications/clarifications are in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner. If Contractor initiated system changes have been made, that alters the commissioning process, the EC will contact the Commissioning Agent and Owner Representative for approval.
- C. Normal start-up services required bringing each system to a fully operational state. This includes cleaning, filling, leak testing, motor rotation check, control sequence of operation, full and part load performance, etc. The Commissioning Agent will not begin the commissioning process until each system is complete, including the completion of normal contractor start-up.
- D. Commissioning is intended to begin upon the completion of a system. Commissioning may proceed prior to the completion of the systems or sub-systems and will be coordinated with the Commissioning Agent. Start of commissioning before system completion will not relieve Division 26 from completing those systems as per the schedule.

### 3.2 PARTICIPATION IN COMMISSIONING

- A. Provide skilled technicians to start up all systems within Division 26. These same technicians shall be made available to assist the Commissioning Agent in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc. will be requested and coordinated by the contractor. Division 26 will ensure that qualified technicians are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustment and problem resolution.
- B. System problems and discrepancies may require additional technician time. The additional technician time shall be made available for subsequent commissioning periods until required system performance is obtained.
- C. The Owner's Representative reserves the right to judge the appropriateness and qualification of the technicians relative to each item of equipment or system. Qualifications for technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service the equipment and attitude/willingness to work with the contractor to get the job done.

### 3.3 WORK TO RESOLVE DEFICIENCIES

- A. In some systems, maladjustment, misapplied equipment and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work will be completed under the direction of the Owner's Representative and the Architect/Engineer, with input from the Contractor and equipment supplier. Whereas all members will have input and the opportunity to discuss the work and resolve problems, the Architect/Engineer will have final jurisdiction on the necessary work to be done to achieve the necessary performance.
- B. Corrective work shall be completed in a timely manner to permit completion of the commissioning process. If deadlines pass without resolution of the problems, the Owner reserves the right to obtain supplementary services and/or to correct the problems at the Contractor's responsibility in an expeditious manner.

### 3.4 RETESTING AND RECOMMISSIONING

- A. Any fault in material or in any part of the installation revealed by commissioning tests shall be investigated, replaced or repaired by the Contractor and the same test repeated at the Contractor's expense until no fault appears.

### 3.5 TRAINING

- A. Participate in the training of the Owner's engineering and maintenance staff, as required in Division 26 on each system and related components.

### 3.6 CHART OF RESPONSIBILITIES

Product		Developed By
1	Final Commissioning plan	CxA
2	Meeting minutes	CxA
3	Commissioning schedule	CxA with Owner and EC
4	Equipment documentation submittals	Subcontractors
5	Sequence of clarifications	Subcontractors and A/E as needed or by design
6	Prefunctional checklists	CxA
7	Startup and initial checkout plan	Subcontractors and CxA (complication of existing documents)
8	Startup and initial checkout plan filled out	Subcontractors
9	Final TAB report	TAB
10	Issues log (deficiencies & recommendations)	CxA
11	Commissioning Progress Record	CxA
12	Deficiency reports	CxA
13	Filled out functional tests	CxA with subcontractors assistance
14	O&M manuals	Subcontractors
15	Commissioning record book	CxA
16	Overall training plan	AE and EC
17	Specific training agendas	Subcontractors
18	Final commissioning report	CxA
19	Misc approvals	CxA

END OF SECTION 260800



## SECTION 260943 - DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

A. Distributed Digital Lighting Control System: System includes

1. Digital Lighting and Plug Load Controls
2. Relay Panels
3. Emergency Lighting Control.

#### 1.2 RELATED SECTIONS

- A. Section 270539 - Surface Raceways for Communications Systems
- B. Section 265000 - Lighting.
- C. Section 265200 - Emergency Lighting.
- D. Section 255500 - Integrated Automation Control of HVAC- Integrated Automation, Building integrator shall provide integration of the lighting control system with Building Automation Systems.

#### 1.3 REFERENCES

- A. NFPA 70 - National Electrical Code; National Fire Protection Association.
- B. NEMA - National Electrical Manufacturers Association
- C. FCC emission standards
- D. UL - Underwriters Laboratories, Inc. Listings
- E. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.
- F. UL 20 - General Use Switches, Plug Load Controls
- G. UL 924 - Standard for Emergency Lighting and Power Equipment
- H. ULC - Underwriter Laboratories of Canada Listings

#### 1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
- B. System shall conform to requirements of NFPA 70.
- C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.
- D. System shall be listed under UL sections 916 and/or 508.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Catalog sheets and specifications.
  - 2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
  - 3. Storage and handling requirements and recommendations.
  - 4. Installation instructions.
- C. Shop Drawings: Wiring diagrams a for the various components of the System specified including:
  - 1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
  - 2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
  - 3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
  - 4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- E. Closeout Submittals:
  - 1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
  - 2. Operation and Maintenance Manual:
    - a. Include approved Shop Drawings and Product Data.
    - b. Include Sequence of Operation, identifying operation for each room or space.
    - c. Include manufacturer's maintenance information.
    - d. Operation and Maintenance Data: Include detailed information on device programming and setup.
    - e. Include startup and test reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.
- B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.
- C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.7 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.
- B. Review installation procedures and coordination required with related Work and the following:
  - 1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
  - 2. Review the specifications for low voltage control wiring and termination.
  - 3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
  - 4. Discuss requirements for integration with other trades
- C. Inspect and make notes of job conditions prior to installation:
  - 1. Record minutes of the conference and provide copies to all parties present.
  - 2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
  - 3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

1.9 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
2. Relative humidity: Maximum 90 percent, non-condensing.

#### 1.10 WARRANTY

- A. Products Warranty: Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Legrand Building Controls Wattstopper, which is located at: 2700 Zanker Rd., Suite 168; San Jose, CA 95134; Tel: 408.988.5331; Fax: 408.988.5373;
- B. Or Approved Equal by Intelligent Lighting Controls Inc. or Dynalite Controls by Philips

#### 2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

- A. System General: Provide a Legrand Building Controls Wattstopper, Provide Digital Lighting Management System (DLM) complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing and this Specification, contact the Architect for clarification prior to proceeding.
  1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
  2. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
    - a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
    - b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
    - c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
    - d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

- B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
  2. Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
  3. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
  4. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
  5. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
  6. Configuration Tools: Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.
  7. Digital Lighting Management (DLM) segment network: Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded) to connect multiple DLM local networks for centralized control.
  8. Programming and Configuration Software: Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.
  9. Digital Lighting Management Relay Panel and Zone Controller: Provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS). Zero relay Zone Controller primarily supports Digital Fixture Controller applications.
  10. Emergency Lighting Control Unit (ELCU): Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building
- C. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
1. Features of the DLM local network include:
    - a. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
    - b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
    - c. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.

- d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
2. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
3. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

## 2.3 DIGITAL LOAD CONTROLLERS (ROOM, PLUG LOAD AND FIXTURE CONTROLLERS)

- A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
4. Device Status LEDs to indicate:
  - a. Data transmission
  - b. Device has power
  - c. Status for each load
  - d. Configuration status
5. Quick installation features including:
  - a. Standard junction box mounting
  - b. Quick low voltage connections using standard RJ-45 patch cable
6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
  - a. Turn on to 100 percent
  - b. Turn off
  - c. Turn on to last level
7. Each load be configurable to operate in the following sequences based on occupancy:

- a. Auto-on/Auto-off (Follow on and off)
  - b. Manual-on/Auto-off (Follow off only)
8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9. BACnet object information shall be available for the following objects:
  - a. Load status
  - b. Schedule state, normal or after-hours
  - c. Demand Response enable and disable
  - d. Room occupancy status
  - e. Total room lighting and plug loads watts
  - f. Electrical current
  - g. Total watts per controller
  - h. Total room watts/sq ft.
  - i. Force on/off all loads
10. UL 2043 plenum rated
11. Manual override and LED indication for each load
12. Zero cross circuitry for each load
13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
14. Dimming Room Controllers shall share the following features:
  - a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
  - b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
  - c. The following dimming attributes may be changed or selected using a wireless configuration tool:
    - 1) Establish preset level for each load from 0-100 percent
    - 2) Set high and low trim for each load
    - 3) Initiate lamp burn in for each load of either 0, 12 or 100 hours
  - d. Override button for each load provides the following functions:
    - 1) Press and release for on/off control
    - 2) Press and hold for dimming control
  - e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
  - f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.

- g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
- h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

B. On/Off Room Controllers shall include:

- 1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load
- 2. One or two relay configuration
- 3. Simple 150 mA switching power supply (Only 4 100 series devices on a Cat 5e local network)
- 4. Three RJ-45 DLM local network ports with integral strain relief and dust cover
- 5. Legrand Building Controls Wattstopper product numbers: LMRC-101, LMRC-102

C. On/Off/0-10V Dimming KO Mount Room Controllers shall include:

- 1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 10A total load
- 2. Optional real time current and voltage monitoring (with - M Monitoring option).
- 3. One or two relays configurations
- 4. Smart 150 mA switching power supply
- 5. Two RJ-45 DLM local network ports. Provide molded strain relief ring
- 6. One dimming output per relay
  - a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting
- 7. Units capable of providing both Class 1 or Class 2 wiring for the 0-10V output
- 8. Legrand Building Controls Wattstopper product numbers: LMRC-111, LMRC-111-M, LMRC-112, or LMRC-112-M.

D. On/Off/0-10V Dimming Enhanced Room Controllers shall include:

- 1. Dual voltage (120/277 VAC, 60 Hz) capable or 347 VAC, 60 Hz. 120/277 volt models rated for 20A total load; 347 volt models rated for 15A total load
- 2. Built in real time current monitoring
- 3. One, two or three relays configurations
- 4. Smart 250 mA switching power supply
- 5. Four RJ-45 DLM local network ports. Provide integral strain relief
- 6. One dimming output per relay
  - a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting (LMRC-110 series and 210 series).
- 7. Legrand Building Controls Wattstopper product numbers: LMRC-211, LRMC-212, LRMC-213.

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR



- A. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
1. Digital calibration and pushbutton configuration for the following variables:
    - a. Sensitivity, 0-100 percent in 10 percent increments
    - b. Time delay, 1-30 minutes in 1 minute increments
    - c. Test mode, Five second time delay
    - d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
    - e. Walk-through mode
  2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
  3. Programmable control functionality including:
    - a. Each sensor may be programmed to control specific loads within a local network.
    - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
    - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
    - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
      - e. Ultrasonic and Passive Infrared
      - f. Ultrasonic or Passive Infrared
      - g. Ultrasonic only
      - h. Passive Infrared only
    - i. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
  4. One or two RJ-45 port(s) for connection to DLM local network.
  5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
  6. Device Status LEDs, which may be disabled for selected applications, including:
    - a. PIR detection
    - b. Ultrasonic detection
    - c. Configuration mode
    - d. Load binding
  7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
  8. Manual override of controlled loads.
  9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:

1. Detection state
  2. Occupancy sensor time delay
  3. Occupancy sensor sensitivity, PIR and Ultrasonic
- C. Units shall not have any dip switches or potentiometers for field settings
- D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- E. Legrand Building Controls Wattstopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

## 2.5 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
  2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
  3. Configuration LED on each switch that blinks to indicate data transmission.
  4. Load/Scene Status LED on each switch button with the following characteristics:
    - a. Bi-level LED
    - b. Dim locator level indicates power to switch
    - c. Bright status level indicates that load or scene is active
    - d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
  5. Programmable control functionality including:
    - a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
    - b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
  6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
1. Button state
  2. Switch lock control
  3. Switch lock status
- C. Two RJ-45 ports for connection to DLM local network.
- D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

- E. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
  - 1. Individual button function may be configured to Toggle, On only or Off only.
  - 2. Individual scenes may be locked to prevent unauthorized change.
  - 3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
  - 4. Ramp rate may be adjusted for each dimmer switch.
  - 5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
  - 6. Legrand Building Controls Wattstopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

## 2.6 DIGITAL DAYLIGHTING SENSORS

- A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
  - 1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
  - 2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
  - 3. Dual loop sensors measure both ambient and incoming daylight in the space to insure, that proper light levels are maintained as changes to reflective materials are made in a single zone
- B. Digital daylighting sensors shall include the following features:
  - 1. Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.
  - 2. Sensor light level range shall be from 1-6,553 foot-candles (fc).
  - 3. Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
  - 4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
  - 5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
  - 6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
  - 7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.

8. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
9. Configuration LED status light on device that blinks to indicate data transmission.
10. Status LED indicates test mode, override mode and load binding.
11. Recessed switch on device to turn controlled load(s) ON and OFF.
12. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
  - a. Light level
  - b. Day and night setpoints
  - c. Off time delay
  - d. On and off setpoints
  - e. Up to three zone setpoints
  - f. Operating mode - on/off, bi-level, tri-level or dimming
13. One RJ-45 port for connection to DLM local network.
14. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.
15. Any load or group of loads in the room can be assigned to a daylighting zone
16. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
17. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

## 2.7 HANDHELD CONFIGURATION TOOLS

- A. Provide a wireless configuration tool to facilitate customization of DLM local networks using two-way infrared communications, and/or PC software that connects to each local network via a USB interface.
- B. Features and functionality of the wireless configuration tool shall include but not be limited to:
  1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
  2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
  3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
  4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.

5. Temporarily adjust light level of any load(s) on the local network and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
8. Verify status of building level network devices.

C. Legrand Building Controls Wattstopper Product Numbers: Handheld LMCT-100

## 2.8 DLM SEGMENT NETWORK

A. Provide a segment network using linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.

1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.
3. Segment network utilizes 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. Maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
4. Network wire jacket is available in high visibility green, white, or black.
5. Substitution of manufacturer-supplied cable is not permitted and may void the warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.
6. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.
7. Segment networks shall be capable of connecting to any of the following: BACnet-compliant BAS (provided by others) directly via MS/TP, or BACnet/IP via an NB-ROUTER or LMSM Unit. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable

B. Legrand Building Controls Wattstopper Product Number: LM-MSTP, LM-MSTP-W, LM-MSTP-B, LM-MSTP-DB

## 2.9 LMCP LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER

A. Hardware: Provide LMCP lighting control panels in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction and consist of the following components:

1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.

3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. Interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. Panel interiors shall include the following features:
  - a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
  - b. Individual terminal block, override pushbutton, and LED status light for each relay.
  - c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
  - d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
  - e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
  - f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
  - g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.
  - h. Relay group status shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.
4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
  - a. Electrical:
    - 1) 30 amp ballast at 277V
    - 2) 20 amp ballast at 347V
    - 3) 20amp tungsten at 120V
    - 4) 30 amp resistive at 347V
    - 5) 1.5 HP motor at 120V
    - 6) 14,000 amp short circuit current rating (SCCR) at 347V
    - 7) Relays shall be specifically UL 20 listed for control of plug-loads
  - b. Mechanical:
    - 1) Replaceable, 1/2 inch KO mounting with removable Class 2 wire harness.
    - 2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
    - 3) Dual line and load terminals each support two #14 - #12 solid or stranded conductors.

- 4) Tested to 300,000 mechanical on/off cycles.
5. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
6. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
7. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
8. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
  - a. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 networked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
  - b. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
  - c. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
  - d. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
    - 1) Scheduled ON / OFF
    - 2) Manual ON / Scheduled OFF
    - 3) Astro ON / OFF (or Photo ON / OFF)
    - 4) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
  - e. User interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
  - f. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
  - g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.
9. Lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.

10. Lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
  - a. Panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
  - b. Panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
  - c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object present value property.
  - d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.
  - e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.
  - f. Setup and commissioning of panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
    - 1) Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.
    - 2) Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after hours schedule control.
    - 3) Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.
    - 4) Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.
  - g. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
  - h. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (<http://www.bacnet.org/Addenda/Add-135-2010aa.pdf>)
  - i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
  - j. Lockout of all digital switch buttons connected to a given panel shall be commandable via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.



11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:
    - a. Use the same intelligence board as the LMCP relay panel.
    - b. Shall not include relay driver boards or relays.
    - c. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.
    - d. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.
    - e. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.
  12. To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n' Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50 percent output when any digital occupancy sensor detects motion.
  13. Legrand Building Controls Wattstopper Product Number: Relay Panels: LMCP8, LMCP24 or LMCP48, Zone Controller: LMZC-301.
- B. User Interface: Each lighting control panel system shall be supplied with at least one handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:
1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
  2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
  3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
  4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
  5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
  6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
  7. Legrand Building Controls Wattstopper Product Number: LMCT-100

2.10 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

- A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.
- B. Additional parameters exposed through this method include but are not limited to:
  - 1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
  - 2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
  - 3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
  - 4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
  - 5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
  - 6. Load control polarity reversal so that on events turn loads off and vice versa.
  - 7. Per-load DR (demand response) shed level in units of percent.
  - 8. Load output pulse mode in increments of 1 second.
  - 9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.
- C. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
  - 1. Device list report: All devices in a project listed by type.
  - 2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
  - 3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
  - 4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
  - 5. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
  - 6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).
  - 7. Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.
- D. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
  - 1. Set, copy/paste an entire project site of sensor time delays.

2. Set, copy/paste an entire project site of sensor sensitivity settings.
  3. Search based on room name and text labels.
  4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
  5. Filter by parameter value to search for product with specific configurations.
- E. Network-wide firmware upgrading remotely via the BACnet/IP network.
1. Mass firmware update of entire rooms.
  2. Mass firmware update of specifically selected rooms or areas.
  3. Mass firmware upgrade of specific products
- F. Legrand Building Controls Wattstopper Product Number: LMCS-100, LMCI-100

## 2.11 EMERGENCY LIGHTING CONTROL DEVICES

- A. Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
  2. Push to test button
  3. Auxiliary contact for remote test or fire alarm system interface
- B. Legrand Building Controls Wattstopper Product Numbers: ELCU-100, ELCU-200.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Do not begin installation until measurements have been verified and work areas have been properly prepared.
- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

### 3.2 INSTALLATION

- A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.
- B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.

1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
  2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.
  3. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
  4. Low voltage wiring topology must comply with manufacturer's specifications.
  5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.
- C. All line voltage connections shall be tagged to indicate circuit and switched legs.
- D. Test all devices to ensure proper communication.
- E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.
- F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
  2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
  3. Load Parameters (e.g. blink warning, etc.)
- G. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.
- H. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.
- I. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.
- J. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.
- K. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.
- L. Remote Access for Network Systems: If "REMOTE ACCESS AND ENHANCED WARRANTY FOR NETWORKED SYSTEMS" is specified in Part 1 of this specification, ensure Segment Manager enclosure is installed in a location with good to excellent cellular phone coverage based on building orientation and geographic location, and mount magnetic antenna for the modem. For cases where alternate mounting locations are not available and a stronger cellular signal is needed, the manufacturer shall offer additional antenna options to improve signal quality. Verify final mounting location with Engineer and Owner prior to proceeding with the Work.

### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.
- B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
  - 1. Verify Class I and II wiring connections are terminated properly by validating system performance.
  - 2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
  - 3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
  - 4. Verify that the control of each space complies with the Sequence of Operation.
  - 5. Correct any system issues and retest.
- C. Provide a report in table format with drawings or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
  - 1. Date of test or inspection.
  - 2. Loads per space, or Fixture Address identification.
  - 3. Quantity and Type of each device installed
  - 4. Reports providing each device's settings.

### 3.4 PRODUCT SUPPORT AND SERVICE

- A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION 230923

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## SECTION 260924 - OCCUPANCY SENSOR

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.
- B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.
- C. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

#### 1.2 EQUIPMENT QUALIFICATION

- A. Products supplied shall be from a single manufacturer that has been continuously involved in manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.
- B. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.
- C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.
- D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

#### 1.3 SYSTEM DESCRIPTION

- A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.
- B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

- C. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with specifications. The supplier's obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

#### 1.4 SUBMITTALS

- A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.
- B. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.
- C. Submit any interconnection diagrams per major subsystem showing proper wiring.
- D. Submit standard catalog literature which includes performance specifications indicating compliance to the specification.
- E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

#### 1.5 SYSTEM OPERATION

- A. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the occupancy system, or;
- B. Factory Startup (Optional): It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system. This service is provided at an additional cost.

### PART 2 - SPECIFIC REQUIREMENTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Watt Stopper or Pre-approved equal: For pre-approval, provide all the information listed under section 1.04A and 1.04D a minimum of ten (10) working days prior to initial bid date.
- B. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received, and submittals made are for sensors which meet or exceed the specifications included herein.

#### 2.2 PRODUCTS

- A. All products shall be Watt Stopper product numbers:



1. Ceiling sensors: UT-305, DT-355
  2. Wall switch sensors: PW-301, UW-100-24, DW-301.  
Wall switch sensor and 0-10v dimmer: PW-311
  3. Power and Auxiliary Packs: BZ-50, BZ-100, BZ-150, BZ-200, BZ-250
  4. Digital Time Switches: TS-400, TS-400-24
  5. Automatic Control Switch: AS-100
- B. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.
- C. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180° coverage capability.
- D. Wall switch products shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
- E. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
- F. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.
- G. Passive infrared sensors shall utilize Pulse Count Processing and Detection Signature Processing to respond only to those signals caused by human motion.
- H. Passive infrared sensors shall provide high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line).
- I. Passive infrared sensors shall have a multiple segmented Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.
- J. Dual technology sensors shall be wall mounted, corner mounted, or ceiling mounted in such a way as to minimize coverage in unwanted areas.
- K. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
- L. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
- M. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within  $\pm 0.005\%$  tolerance, 32 kHz within  $\pm 0.002\%$  tolerance, or 40 kHz  $\pm 0.002\%$  tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
- N. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
- O. Sensors shall utilize SmartSet™ technology for automatically adjustable time delay and sensitivity settings.

- P. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
- Q. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
- R. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
- S. Sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
- T. All sensors shall have UL rated, 94V-0 plastic enclosures.

## 2.3 CIRCUIT CONTROL HARDWARE - CU

- A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.
- B. Relay Contacts shall have ratings of:
  - 13A - 120 VAC Tungsten
  - 20A - 120 VAC Ballast
  - 20A - 277 VAC Ballast
- C. Control wiring between sensors and controls units shall be Class II , 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
- B. It is the contractor's responsibility to arrange a pre-installation meeting with manufacturer's factory authorized representative, at owner's facility, to verify placement of sensors and installation criteria.
- C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

END OF SECTION 260924

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SECTION 262213 - DRY-TYPE DISTRIBUTION TRANSFORMERS (1500 KVA AND BELOW)

PART 1 - GENERAL

1.1 SCOPE

- A. The Contractor shall furnish and install single-phase and three-phase general purpose individually mounted dry-type transformers of the two-windings type, self-cooled as specified herein, and as shown on the contract drawings.

1.2 REFERENCES

- A. The transformers and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of ANSI, NEMA and UL.
- B. Transformers shall meet the requirements of the most current version of federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment".

1.3 SUBMITTALS – FOR REVIEW/APPROVAL

- A. The following information shall be submitted to the Engineer:
  - 1. Outline dimensions and weights
  - 2. Transformer ratings included:
    - a. kVA
    - b. Primary and secondary voltage
    - c. Taps
    - d. Basic impulse level (BIL) for equipment over 600 volts
    - e. Design impedance
    - f. Insulation class and temperature rise
    - g. Sound level
  - 3. Product data sheets

1.4 SUBMITTALS – FOR CONSTRUCTION

- A. The following information shall be submitted for record purposes.
  - 1. Final as-built drawings and information for items listed in Paragraph 1.3, and shall incorporate all changes made during the manufacturing process
  - 2. Connection diagrams
  - 3. Installation information

1.5 QUALIFICATIONS

- A. The manufacturer of the dry-type distribution transformers shall be the same as the manufacturer of the other major electrical distribution equipment on the project.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer shall be a participant in the UL Data Acceptance Program (DAP) under the Client Test Data Program (CTDP) certification to ensure UL test methodologies and record traceability complies with the requirements of ISO 17025.
- D. Transformer must bear the UL Energy Efficiency Verification Mark to confirm that the unit meets the requirements of 10 CFR Part 431.
- E. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years.

#### 1.6 REGULATORY REQUIREMENTS

- A. All transformers shall be UL listed and bear the UL label.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

#### 1.8 OPERATION AND MAINTENANCE MANUALS

- A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Eaton/Cutler-Hammer products
- B. Square D
- C. General Electric
- D. Siemens
- E. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

## 2.2 RATINGS

- A. The kVA and voltage ratings shall be as indicated on the Drawings.
- B. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.
- C. Transformer shall meet the requirements of the most current version of federal law 10 CFR Part 431 "Energy Efficiency Program for Certain Commercial and Industrial Equipment".
- D. Transformers efficiency shall be measured according to federal law 10 CFR Part 431.
- E. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:

Equivalent Winding kVA Range	Self-Cooled Ventilated		Self-Cooled Sealed
	K-Factor = 1 K-Factor = 4 K-Factor = 9	K-Factor = 13 K-Factor = 20	
3.00 and Below	40	40	45
3.01 to 9.00	40	40	45
9.01 to 15.00	45	45	50
15.01 to 30.00	45	45	50
30.01 to 50.00	45	48	50
50.01 to 75.00	50	53	55
75.01 to 112.50	50	53	55
112.51 to 150.00	50	53	55
150.01 to 225.00	55	58	57
225.01 to 300.00	55	58	57
300.01 to 500.00	60	63	59
500.01 to 700.00	62	65	61
700.01 to 1000.00	64	67	63
Greater than 1000	Consult Factory	Consult Factory	Consult Factory

## 2.3 CONSTRUCTION – GENERAL PURPOSE TRANSFORMERS

- A. Insulation Systems
  - 1. Transformer insulation system shall be as follows:
    - a. Less than 15 kVA: 180 degrees C insulation system with 115 degree C rise, encapsulated design; 15 kVA and above: minimum of 200 degree C insulation system with 115degree C rise, ventilated design.
  - 2. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient, and a 24-hour average ambient of 30 degrees C.
  - 3. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

B. Core and Coil Assemblies

1. Transformer core shall be constructed with high-grade, non-aging, silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade copper with continuous wound construction.
2. On single-phase and three-phase units rated 15 kVA and the core and coil assembly shall be completely encapsulated in a proportioned mixture of epoxy or resin and aggregate to provide a moisture proof, shock-resistant seal. The core and coil encapsulation system shall minimize the sound level.
3. On single-phase and three-phase units rated 15 kVA and above the coils assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture; the core shall be coated with HAPs (Hazardous Air Pollutants) free water reducible electrical varnish to give good corrosion resistance. The assembly shall be installed on vibration-absorbing pads.
4. Terminals shall be welded to the leads of the coils for better conductivity, less maintenance, and lower risk of hot spots. Terminals shall not be spot welded or bolted to the coil leads.

C. Taps

1. Three-phase transformers rated 15 through 300 kVA shall be provided with six 2-1/2% taps, two above and four below rated primary voltage. Three-phase transformers rated greater than 300 kVA shall be provided with manufacturer's standard taps for that rating.
2. All single-phase transformers, and three-phase transformers rated below 15 kVA and above 500 kVA, shall be provided with the manufacturer's standard tap configuration.

D. Electrostatic Shielding

1. Provide shielded isolation transformers with an electrostatic shield consisting of a single turn of aluminum placed between the primary and secondary winding and grounded to the housing of the transformer.
  - a. Electrostatic shield shall provide primary to secondary winding capacitance between 24 and 18 picofarads over the range of 100 Hz to 20 kHz.

2.4 WIRING/TERMINATIONS

- A. Recommended external cable shall be rated 90 degrees C sized at 75 degrees C ampacity) for encapsulated and 75 degrees C for ventilated designs. Connectors should be selected on the basis of the type and cable size used to wire the specific transformer.

2.5 ENCLOSURE



- A. The enclosure shall be made of heavy-gauge steel. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 degrees C. The core of the transformer shall be grounded to the enclosure.
- B. On three-phase units rated 15 kVA and below and single-phase units rated 15 kVA and below the enclosure construction shall be encapsulated, totally enclosed, non-ventilated, NEMA 3R, with lifting provisions.
- C. On three-phase units rated 15 kVA and above and single-phase units rated 15 kVA and above the enclosure construction shall be ventilated, NEMA 2, drip-proof, with lifting provisions. All ventilation openings shall be protected against falling dirt. On outdoor units, provide weathershields over ventilated openings.
- D. Ventilated type transformers that meet 10 CFR Part 431 efficiency requirements, with a core size of 150 kVA or less, shall be suitable for installation with 2-inch clearance from a wall or other obstruction behind the transformer enclosure.

## 2.6 FINISH

- A. Steel enclosures shall be finished with ANSI 61 color, weather-resistant enamel.

## PART 3 - EXECUTION

### 3.1 FACTORY TESTING

- A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
  - 1. Ratio tests at the rated voltage connection and at all tap connections.
  - 2. Polarity and phase relation tests on the rated voltage connection.
  - 3. Applied potential tests.
  - 4. Induced potential test.
  - 5. No-load and excitation current at rated voltage on the rated voltage connection.

### 3.2 INSTALLATION

- A. Transformers shall be floor mounted except where indicated on the Drawings to be suspended or wall mounted.
- B. Suspended transformers shall be mounted on hanger rods with a spring isolator in each rod.
- C. Floor mounted transformers shall be mounted on 4 inch high concrete housekeeping pads. Provide neoprene pads between transformer legs and housekeeping pad and anchor transformer to floor.

- D. Provide grounding electrode conductor from transformer secondary neutral to nearest effectively grounded building structural steel.
- E. Conduit connected to transformers shall be flexible metal conduit, 24 inches minimum length, 60 inches maximum length.

### 3.3 FIELD ADJUSTMENTS

- A. Adjust taps to deliver appropriate secondary voltage.

### 3.4 FIELD TESTING

- A. Measure primary and secondary voltages for proper tap settings.

END OF SECTION 262213

## SECTION 262416 – PANELBOARDS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. General: Provide panelboards in accordance with the Contract Documents.

#### 1.2 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
  - 1. Panelboards
    - a. UL Standards #67.
    - b. UL Standard 50 Cabinet and Boxes
    - c. Federal Standard W-P-115.
    - d. NEMA Standard PB-1
    - e. Circuit Breakers – Type 1, Class 1.

#### 1.3 SUBMITTALS

- A. Submittals will be furnished. Submittals failing to meet the following criteria will be returned without a review or acceptance.
- B. With each panelboard drawing the following is required:
  - 1. Show main devices and lug sizes; branch circuit device sizes and arrangement; bus ampacities; withstandability and short circuit rating; dimensions and construction; gutter and backbox dimensions; nameplate and legend; protective coating; and all pertinent details of panel, enclosure, cover, and method of securing cover and lock.

#### 1.4 QUALITY ASSURANCE

- A. Each panelboard as a complete and finished product shall receive a single integrated equipment rating by the manufacturer. The integrated equipment short circuit rating shall certify that all equipment is capable of withstanding the thermal and magnetic stress of a fault equal to the value specified on the Drawings. Such rating shall be established by actual tests by the manufacturer on similar equipment. This certification shall be permanently affixed to each panelboard. Test data shall be submitted to the Engineer at time of submission of Acceptance Drawings.

### PART 2 - PRODUCTS

## 2.1 APPROVED MANUFACTURERS

- A. Eaton
- B. Square D
- C. General Electric
- D. Siemens
- E. 277/480 volts circuit breaker type panelboards are to be equal to Eaton Pow-R – Line 2.
- F. 120/280 volts circuit breaker type panelboards are to be equal to Eaton Pow-R Line 1.

## 2.2 PANELBOARDS IN GENERAL

- A. Provide panelboards consisting of an assembly of branch circuit switching and protective devices (circuit breakers, switch and fuse units, or combination thereof) mounted inside a dead front enclosure. Provide the number and size of these branch circuit devices as indicated by the circuiting, on the drawings, and in the schedules.
- B. Provide the following modifications and additional equipment as shown on the Drawings:
  - 1. Main circuit breakers.
  - 2. Shunt trip circuit breakers.
  - 3. Ground fault interrupting circuit breakers.
- C. Interiors
  - 1. Rigid removable assembly of copper bus bars and interchangeable bolted branch circuit devices.
  - 2. Bus bars drilled to permit branch circuit devices of all sizes and number of poles to be interchangeable and installed in any spare space of sufficient size, without disturbing adjacent units; without removing main bus or branch circuit connectors and without machining, drilling, or tapping in the field.
  - 3. Arrange bus in sequence or distributed phasing so that multipole circuit breaker can replace any group of single circuit breakers of the same size.
  - 4. Provide neutral bus in each panelboard.
  - 5. Provide ground bus in each panelboard.
- D. Enclosure
  - 1. Code gauge steel box galvanized.
  - 2. Provide a bolt-on ground connector to inside of enclosure.
  - 3. Flush mounted in finished areas and where indicated. Surface mount elsewhere.
- E. Front
  - 1. Doors must be provided on all lighting and power distribution panels. On switch and fuse panelboards, doors for overcurrent devices are not to be provided.

2. Heavy code gauge steel as required to maintain panel face flat.
3. Hold front closed with trim clamps.
4. Factory finished in medium gray enamel or two coats of air-drying lacquer over a rust inhibitor.
5. Provide directory for total number of poles.
6. Provide approved lock. All panels keyed alike. Furnish 4 sets of matching keys to the Owner.
7. Welded angle rest at the bottom of the door to facilitate cover installation.
8. Doors over 48" in height shall have auxiliary fasteners at top and bottom of door in addition to lock and catch.
9. Door-in-door construction.

F. Terminal lugs

1. Bolted type, labeled for either copper or aluminum conductors.
2. Locate main lugs properly at top or bottom, depending where main feeder enters.

G. Electrical Ratings

1. Panelboards are to be rated 120/208 or 277/480 volts 3 phase, 4 wire, full neutral with ampacities as indicated on the Drawings (unless otherwise noted).
2. Short circuit withstand ratings shall be as indicated on the Drawings. Panelboards shall be fully rated. Series rated not acceptable.
3. Where indicated, provide panelboards having a "service entrance" Type UL label with neutrals factory bonded to frame or enclosure.

H. Circuit Breaker Devices

1. Plastic molded case. Completely sealed enclosure. Toggle type operating handle. Trip ampere rating and ON/OFF indication clearly visible.
2. Thermal-magnetic trip-free, trip-indicating, quick-make, quick-break, with inverse time delay characteristics. Single-handle and common tripping multipole breakers.
3. Silver alloy contacts with auxiliary arc-quenching devices.
4. Panelboard must be of the type which will accept the field installation of shunt trip devices of 60 amperes or less on the branch devices.
5. Interrupting capacities shall be as indicated on the Drawings. In general, 120/208 volt devices shall be not less than (10,000 AIC). And 277/480 not less than (14,000 AIC).
6. Arc Fault Circuit Breaker Devices shall be equipped with 5mA ground fault protection integrated design capability. Provide arc fault breakers (AFCI) for all bedroom lighting and power 15-ampere and 20-ampere single pole 120Volt circuits indicated on the plans.
7. For lighting circuits that are controlled at panel, provide devices labeled "SWD" for switching purposes.
8. Bolted type terminals UL listed for either aluminum or copper 75 degrees C cables.
9. Provide main breakers in panels served from transformers.
10. Locate next to each breaker or space unit an individual number.
11. Circuit breakers serving kitchen equipment beneath cooking hoods shall include a shunt trip coil.
12. Panelboard shall accept circuit breakers from 15 ampere to 100 ampere.

I. Life Safety Circuit Breakers

1. For all main and sub-feed circuit breakers for the life safety distribution system, the circuit breakers shall be provided with electronic trip unit with LSI settings. This is required for selective coordination. Branch circuit breakers in panelboards may be thermal magnetic trip.

J. Ground Fault Interrupters

1. Ground fault interrupter branch circuit breakers shall be as indicated in panel schedules. Circuit breakers shall be circuit interrupting which will operate manually for normal switching functions and automatically under overload, short circuit, and 0.005 amp line-to-ground fault conditions. The operation mechanism shall be entirely trip-free so that contact cannot be held closed against an abnormal overcurrent, short circuit, or ground fault condition. The device shall be bolt-on type with insulated case construction and shall be interchangeable with standard 1 P breakers utilized in the panelboard.

2.3 DISTRIBUTION PANELBOARDS

- A. Where indicated, provide circuit breakers UL listed for application at **80%** of their continuous ampere rating in their intended enclosure.

- B. Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

C. Trip Units for Molded Case Circuit Breakers – 1200 A and Below

1. Protective devices shall be molded case circuit breakers with inverse time and instantaneous tripping characteristics and shall be Eaton or approved equal.
2. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
3. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.
4. Circuit breakers 225-ampere frame and below shall have thermal-magnetic trip units and inverse time-current characteristics.
5. Circuit breakers 250-ampere through 1200-ampere frame shall have microprocessor-based rms sensing trip units.
6. Ground fault protection shall be provided where indicated.

D. Enclosure

1. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
2. Enclosures shall be provided with blank ends.

E. Nameplates

1. Provide an engraved nameplate for each panel section.

## 2.4 SURGE PROTECTIVE DEVICES

- A. Provide surge protective devices as specified in Section 264313.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Mount panel 4 feet to panel center but with maximum height of 6 feet 6 inches to handle of topmost switching device.
- B. Mount surface type panels a minimum of 1 inch off wall on channels.
- C. Connect feed-through panels to main feeder by insulated parallel gutter taps. Full-size tap for two panels on a common feeder. Increase cabinet width to accommodate gutter tap.
- D. Where flush mounted, the fire integrity of the wall in which it is installed must be maintained.
- E. Neatly arrange branch circuit wires and tie together in each gutter with Thomas & Betts nylon "Ty-Raps" or approved equal at minimum 4 inch intervals.
- F. Plug all knockouts removed and not utilized.

### 3.2 TOUCH UP AND CLEANING

- A. Vacuum all backboxes clean of debris after installation and prior to final payment.
- B. Touch up scratch marks, etc. with matching paint.

END OF SECTION 262416

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## SECTION 262719 - MULTI-OUTLET ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Provide surface metal raceways multi-outlet assemblies in accordance with the Contract Documents.

#### 1.2 STANDARDS

- A. Except as modified by governing codes and the Contract Documents, comply with the applicable provisions and recommendations of the following:
  - 1. Underwriters' Laboratories, UL-5.
  - 2. Federal Specifications W-C-582.

#### 1.3 SUBMITTALS

- A. Shop Drawings: Submit manufacturer's catalog cuts and specifications for multi-outlet assemblies. Submittal shall include but is not limited to, wiring devices, mounting and installation methods, and all fittings, connectors and coverplates.

### PART 2 - PRODUCTS

#### 2.1 MULTI-OUTLET ASSEMBLY

- A. Surface Raceway
  - 1. These raceways shall be installed only where noted on the drawings. Size and numbers as shown are those of "Wiremold".
  - 2. Surface metal raceway shall be 700 series by Wiremold Company.
  - 3. Provide and install surface metal raceways and appropriate fittings to provide a safe and complete installation.
  - 4. Provide all fittings including, but not limited to, bushings to prevent wire abrasion, single and multiple gang boxes to accommodate device installation for both new work and extension of existing work, adapters from conduit to raceway, transitions to both larger and smaller SMR< 90 degree elbows, tees, fixture boxes and flexible sections to allow uninterrupted continuation of raceway along semi-circular or curved surfaces.
  - 5. Surface metal raceways colors shall be factory applied baked enamel.
- B. Wiring Devices

1. Duplex receptacles as specified in other section shall be a 20A, 125V, 3 wire grounding type. Receptacle spacing shall be 12" on center unless noted otherwise. Total raceway length shall be as noted on the Drawings.
- C. Telephone/Data Outlets
1. Telephone/data outlets shall be Leviton extreme UTP category 6A.
- D. Wire
1. All assemblies shall be provided with a separate ground wire. Use of the raceway for grounding purposes is not allowed.
  2. All conductors shall be copper with type 'THHN' insulation.
- E. Raceways
1. Metal raceway construction shall be a minimum of .04" sheet steel.
  2. Raceway cover shall be removable along the complete and continuous length of the assembly.
  3. Raceway cover shall snap onto the body of the raceway and must provide a secure cover connection that will not become unintentionally unattached under normal use.
  4. Raceway finish shall be factory applied enamel paint or stainless steel. Standard color shall be ivory unless noted otherwise as color by Architect.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Installation shall be done in a workmanlike manner, complete, with all raceway joints provided with coverplates, and other necessary fittings for a neat installation provided.
- B. No power circuit wiring other than that providing power to the multi-outlet assembly shall be allowed within the raceway.
- C. All wires extending beyond the last receptacle on the assembly shall be provided with wire nut terminations and the raceway shall be provided with an end fitting.
- D. No cord and plug connected multi-outlet assemblies are allowed. All power connections to multi-outlet assemblies shall be permanent.
- E. Raceways shall be installed partially recessed or surface mounted. No multi-outlet assembly raceways may extend through or be contained in a partition. Reference shall be made to architectural drawings for location of raceways above counters.
- F. Wiring within the raceway shall be supported a minimum of 30" on center and at each splice or raceway connection point.

END OF SECTION 262719

## SECTION 262726 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 DESCRIPTIONS

- A. General: Provide wiring devices in accordance with the Contract Documents.

#### 1.2 QUALITY ASSURANCE

- A. Switches and receptacles shall be of the same manufacturer.
- B. Reference shall be made to the drawings for additional wiring devices not noted in this section of the specifications.
- C. Manufacturer shall have a minimum of ten (10) years experience in the manufacture of wiring devices similar to those specified on this project.
- D. Manufacturer shall have ISO-9002 certification.

#### 1.3 STANDARDS

- A. Switches: Federal Specifications WS-896E.
- B. Receptacles: Federal Specification WC596-D, NEMA WD-1, and UL 498.
- C. Ground Fault Circuit Interrupter Receptacles: UL 943 Class A.
- D. Wall Dimmers: ANSI C62,41, UI 20.

#### 1.4 SUBMITTALS

- A. Manufacturer's product data sheets.

#### 1.5 COLORS

- A. Device and coverplate colors shall be match existing conditions unless otherwise indicated on the architectural drawings:
- B. Switches and receptacles connected to the emergency power system shall be red.

### PART 2 - PRODUCTS

## 2.1 ACCEPTABLE MANUFACTURERS

- A. Catalog numbers shall not be used to determine colors of devices and coverplates. Catalog numbers are used to establish minimum acceptable standard.
- B. Switches and Receptacles: Hubbell or equal.
- C. Wall Dimmers: Lutron or equal.
- D. Floor Boxes and Fittings
  - 1. Poke through type: Hubbell or equal.
  - 2. Recessed flush floor box type: Hubbell or equal.

## 2.2 SWITCHES

- A. General
  - 1. Switches shall be of the type indicated on the Drawings.
  - 2. Switches shall be commercial specification grade, quiet type, 20A, 120/277V, 1 HP rated at 120V, 2HP rated at 240V, back and side wired, silent handle operation.
  - 3. Switch with pilot light shall be specified for applications where the load to be controlled is not in sight. Pilot light shall be long life, neon type and shall be on when the load is on.
- B. Lighting Switches
  - 1. Rocker Handle Type
    - a. Single pole: Hubbell-style line HBL 2121.
    - b. Double pole: Hubbell-style line HBL 2122.
    - c. 3-way: Hubbell-style line HBL 2123.
    - d. 4-way: Hubbell: HBL2124.
- C. Illuminated Handle Switches
  - 1. Rocker Handle Type
    - a. Single pole: Hubbell: HBL 212.
    - b. 3 way: Hubbell: HBL 2123.
- D. Momentary Contact Switches
  - 1. Toggle handle type, center off: Hubbell: HBL1557.
- E. Key Switches
  - 1. Single pole: Hubbell: HBL1221.
- F. Weatherproof Switches
  - 1. Weatherproof handle/coverplate: Hubbell: HBL1795.

## 2.3 RECEPTACLES

### A. General

1. Receptacles shall be of the type indicated on the Drawings.
2. Receptacles shall be heavy duty 20A specification grade, 125V, grounding type, back and side wired.

### B. Receptacles

1. Duplex, 20A: Hubbell: HBL5362.
2. Style Line duplex, 20A: Hubbell: HBL2162.

### C. Surge Suppression Receptacle

1. Duplex, 20A Hubbell: HBL5362SA

### D. Ground Fault Circuit Interrupter Receptacles

1. Duplex, 20A: Hubbell: GF20L

### E. Special purpose receptacles: Rating as indicated on the Drawings.

### F. Weatherproof Receptacles and Cover

1. Exterior weatherproof outlet shall be Hubbell. While in use, cast aluminum, 1 gang vertical, GFCI receptacle Catalog #WP26M or approved equal.

## 2.4 WALL DIMMERS

### A. Wall dimmers shall be suitable for control of the load type (incandescent, low voltage, or fluorescent), load capacity, and branch circuit voltage of the lighting fixtures controlled.

### B. Thin profile, linear slide to off control, power failure memory, front accessible service switch.

### C. Lutron Nova T-Star thin profile series, or equal.

## 2.5 FLOOR BOXES AND FITTINGS

### A. General

1. Provide floor boxes and fittings of the types, ratings, and configurations as shown on the Drawings. Complete with all fittings, wiring devices with tile or carpet assembly.
2. Floor boxes and fittings shall be suitable for the fire rating and thickness of the floor.
3. Combination power/telecom outlets shall have barrier to separate power and telecom wiring.
4. Refer to technology series drawings for all audio/visual floor box specifications.

### B. Fire Rated Poke Through Assembly

1. Fire rated insert, junction box, and service fitting. Combination power/telecom outlets shall have barrier to separate power and telecom wiring. Carpet flange shall be diecast aluminum, painted or plated finish as selected by the Architect.
2. Combination double duplex receptacle/telecom outlet, 125V, 20A: Wiremold RC4 series.
3. Poke through assembly shall be Hubbell system FRPT – 4 inch units or approved equal.

C. Recessed Flush Floor Box

1. Floor boxes in slab on grade shall be cast iron Hubbell Type SICFB or equal.
2. Floor boxes in slabs above grade shall be Hubbell Type SIFSB or equal.

2.6 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic 0.035-inch-thick, satin-finished stainless steel 302/304, 0.03-inch thick
3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in "wet locations".

PART 3 - EXECUTION

3.1 GENERAL

A. General

1. The exact location of wiring devices shall be determined by location of equipment and as detailed on the Architectural Drawings. Prior to installation the Owner has the right to have the devices relocated 25'-0" at no cost.
2. Devices mounted above counters shall be 2 inches above the top of the backsplash to the bottom of the coverplate.

B. Switches

1. Mount switches vertically with the ON position on top.
2. Mount switches on the strike side of doors, unless otherwise detailed on the drawings.

C. Receptacles

1. Mount receptacles vertically with the grounding pin on top.
2. Provide conventional style duplex receptacles in mechanical and electrical equipment rooms and janitor closets. Provide designer style type duplex receptacles to match rocker handle type lighting switches in all other areas.

D. Plug Strip

1. Provide a 1 inch conduit home run to the nearest telecommunications terminal board for each 12 linear feet of telecommunications plug strip.

E. Coverplates

1. Install device plates in full contact with wall surface. Plates shall not project out from the wall.
2. Coverplates for multiple gang wall dimmers shall be continuous flush type tailored to match wall dimmer physical dimensions.

3.2 IDENTIFICATION

- A. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

END OF SECTION 262726

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## SECTION 262813 – FUSES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. General: Provide fuses in accordance with the Contract Documents.

#### 1.2 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
  - 1. UL Standard #198

#### 1.3 SUBMITTALS

- A. Provide a complete set of shop drawings to include let-thru curves for each type of fuse, a schedule of spare fuse cabinets with a listing of fuses provided within each spare fuse cabinet, and dimensioned drawings of each spare fuse cabinet by type and size.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Mains, Feeders and Branch Circuits
  - 1. General
    - a. All fuses shall be labeled as UL Class L or UL Class R, current limiting and rated for up to 200,000 amperes. Time delay Class R fuses shall be so labeled.
  - 2. Main Service and all Feeder Circuits
    - a. Fuses over 600 amperes shall be UL Class L. Fuses up to 600 amperes shall be UL Class RK1. If fuses directly feed motors or transformers, they shall be UL RK1, labeled Time-delay.
  - 3. Branch Circuits
    - a. Feeding circuit breaker panels shall be UL Class RK1.
    - b. Feeding motor circuits shall be UL Class RK1 labeled as Time-delay.
  - 4. All fuses shall be so selected as to provide a selectivity coordinated system.
  - 5. All fuses shall be of the same manufacturer.

6. All fuses to be of the Class R type.
- B. Spares: Upon completion of the building, the contractor shall provide the Owner with spare fuses as indicated below:
  1. 10 percent (minimum of 3) of each type and rating of installed fuses shall be supplied as spares.
  2. Spare fuse cabinets shall be provided to store the above spares.
  3. Spare fuse cabinets shall be provided as a minimum in the following locations:
    - a. Each main switchgear room.
    - b. Each major mechanical equipment room.
- C. Manufacturers
  1. Littelfuse, Bussmann, Gould-Shawmut.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Fuses shall not be installed until equipment is ready to be energized.
- B. All fuses shall be provided by the Electrical Contractor.

END OF SECTION 262813

## SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Provide enclosed fusible disconnect switches and circuit breakers in accordance with the Contract Documents.

#### 1.2 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
  - 1. UL Standards #98
  - 2. NEMA KS-1

#### 1.3 SUBMITTALS

- A. Submit manufacturers' data for all disconnect switches and circuit breakers.

### PART 2 - PRODUCTS

#### 2.1 ENCLOSED SWITCHES

- A. Enclosed switches shall be fused heavy-duty, single-throw knife switch with quick-make, quick-break mechanism, capable of full load operations. Meet NEMA and U.S. Government specifications for Class A switches. Install fused switches unless otherwise noted.
- B. Provide with contact arc-quenching devices, such as magnetic blowouts or snuffing plates. Provide self-aligning switchblades with silver alloy contact areas and designed so that arcing upon making and breaking does not occur on the final contact surfaces. Provide with high-pressure, spring-loaded contact. Mount switch parts on high-grade insulating base. All safety switches shall be fused unless otherwise noted.
- C. Enclosure: NEMA 1 with hinged door, and defeatable interlock when switch is in "On" position and can be positively padlocked in "on" and "off" positions. Utilize NEMA 3R (rain-tight) enclosure for exterior installations. NEMA 3R enclosures must be galvanized.
- D. Size fusing and number of poles as shown or as required. Where fused, the devices must be provided with UL listed rejection feature to reject all but Class R fuses. Provide horsepower rated switch to match motor load if no size is shown. Use 3 pole plus solid neutral switches on four wire circuits and 3 pole switches on all other circuits unless otherwise noted.

- E. Lugs must be UL listed for aluminum and/or copper conductors and be front removable.
- F. Manufacturer to be the same as that for transformers, switchgear, etc.
- G. Acceptable manufacturers: Square D, Cutler-Hammer, General Electric or Siemens.

## 2.2 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
  - 1. Cutler-Hammer
  - 2. General Electric Company
  - 3. Siemens
  - 4. Square 'D'
- B. General Requirements: Comply with UL489, NEMA AB1, and NEMA AB3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers for circuit breakers 100 amperes and below: inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
- D. Electronic Trip Circuit Breakers for circuit breakers 125 amperes and above: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
  - 1. Instantaneous trip.
  - 2. Long- and short-time pickup levels.
  - 3. Long-and short-time time adjustments
  - 4. Ground-fault pickup level, time delay, and  $I^2t$  response.
- E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through rating less than NEMA FU1, RK-5.
- F. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles
  - 2. Lugs: Suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
  - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

## 2.3 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, MENA 250, and UL 50, to comply with environmental conditions at installed location.
  - 1. Indoor, Dry and Clean Locations: NEMA 250 Type A.
  - 2. Outdoor Locations: NEMA 250, Type 3R.
  - 3. Kitchen and Wash-Down Area: NEMA 250, Type 4X, stainless steel.
  - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
  - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Non-corrosive Liquids: NEMA 250, Type 12.

### PART 3 - EXECUTION

#### 3.1 APPLICATIONS

- A. Each piece of equipment utilizing multi-phase power shall be supplied with a safety-type disconnect switch.
- B. Each piece of equipment utilizing single-phase power and protected at over 30 amperes shall be supplied with a safety-type disconnect switch.
- C. Motor disconnects other than mentioned above may utilize a toggle type manual control switch properly sized and rated for the equipment it disconnects.
- D. Factory installed fused disconnect switches may be used to satisfy the above requirements with the Architect's prior approval.

#### 3.2 MOUNTING

- A. Switches or circuit breakers less than 100 pounds may be mounted on the wall. Equipment over 100 pounds shall be mounted on a rack that extends from floor to ceiling. Do not mount switches or circuit breakers to equipment housing.

END OF SECTION 262816

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## SECTION 263213 – EMERGENCY GENERATOR (DIESEL)

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes packaged engine-generator sets for Emergency Standby power supply. Generators shall be equipped with the following features:
  - 1. Diesel engine.
  - 2. Unit-mounted cooling system.
  - 3. Unit-mounted control and monitoring.
  - 4. Performance requirements for sensitive loads.
  - 5. Outdoor Enclosure. Level 2 Sound Attenuated 73 DBA Max.
  - 6. 24 Hour Sub-base Fuel Tank 200 Gallons

#### 1.3 DEFINITIONS

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- B. Diesel Fuel

#### 1.4 SUBMITTALS

- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
  - 1. Thermal damage curve for generator.
  - 2. Time-current characteristic curves for generator protective device.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Dimensioned outline plan and elevation drawings of engine-generator set, and other components specified.

2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
  3. Unit must be seismic certified.
  4. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
  5. Wiring Diagrams: Power, signal, and control wiring.
- C. Qualification Data: For manufacturer and testing agency.
- D. Source quality-control test reports.
1. Certified summary of prototype-unit test report.
  2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
  3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
  4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
  5. Report of sound generation.
  6. Report of exhaust emissions showing compliance with applicable regulations.
  7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
- G. Warranty: Special warranty specified in this Section.
- 1.5 QUALITY ASSURANCE
- A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 50 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.
1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.



- C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with ASME B15.1.
- F. Comply with NFPA 37.
- G. Comply with NFPA 70.
- H. Comply with NFPA 99.
- I. Comply with NFPA 110 requirements for Level 1 emergency power supply system.
- J. Comply with UL 2200.
- K. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
- L. Noise Emission: Comply with applicable state and local government requirements. Maximum of 73 DBA @ 7 Meters. for maximum noise level at due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

#### 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Owner no fewer than two (2) days in advance of proposed interruption of electrical service.
- B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
  - 1. Ambient Temperature: 0 to plus 40 deg C.
  - 2. Relative Humidity: 0 to 95 percent.
  - 3. Altitude: Sea level to 1200 feet.

#### 1.7 COORDINATION

- A. Coordinate size and location of concrete bases for package engine generators Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

- B. Coordinate size and location of roof curbs, equipment supports, and roof penetrations for remote radiators. These items are specified in Division 07 Section "Roof Accessories."

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 5 years from date of commissioning.

#### 1.9 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Maintenance Contract to be Submitted for Owner acceptance after substantial completion.

#### 1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
  - 2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
  - 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance meeting load performance profile. Substitutions with requirements, manufacturers offering products that may be incorporated into this project are:
  - 1. Cummins Power Generation (Basis of Design)
  - 2. Substitutions by Kohler or Caterpillar will be considered if equivalent to the model listed above provided a request is made by the bidding contractor during the bidding phase. Manufacturer must provide a Generator sizing report based on the following project parameters: Max voltage dip 20% and max frequency dip 8%. The substitution will be required to be received in the Engineers office 10 days prior to the bid date. Project loads are available on the construction documents.

#### 2.2 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.

- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
  - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
- C. Capacities and Characteristics:
  - 1. Power Output Ratings: 150 KW
  - 2. Output Connections: 277/480 Vac.
  - 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of components.
- D. Generator-Set Performance:
  - 1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
  - 2. Transient Voltage Performance: Not more than 15 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
  - 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
  - 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
  - 5. Transient Frequency Performance: Less than 7 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
  - 6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
  - 7. Generator Motor Starting KVA shall be a minimum of 770 KVA
  - 8. Alternator Temperature rise shall not exceed 105 Degree C @ 200kw
  - 9. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
  - 10. Start Time: Comply with NFPA 110, Type 10, system requirements.

## 2.3 ENGINE

- A. Fuel:
  - 1. Diesel Ultra Low Sulfur Content Per Current EPA Requirements Tier 2 or 3
  - 2. Rated Engine Speed: 1800 rpm.
- B. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
  2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
  3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- C. Engine Fuel System:
1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
  2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- D. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
- E. Governor: Electronic Adjustable isochronous, with speed sensing.
- F. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
  2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
  3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
  4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
  5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
    - a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and non-collapsible under vacuum.
    - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- G. Cooling System: Closed loop, liquid cooled, with Engine Mounted radiator and integral engine-driven coolant pump.
1. Radiator Core Tubes: Aluminum
  2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
  3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
  4. Fan: Belt Driven
  5. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

6. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
  7. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. installation Mufflers Shall be internal to Genset Enclosures.
  8. Retain second option in paragraph below if filters may not be serviced as often as recommended. If air contaminant level is excessive, consult manufacturers to determine if special filtration of combustion air is needed.
- H. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- I. Starting System: 12/24-Volt electric, with negative ground.
1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
  2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
  3. Cranking Cycle: As required by NFPA 110 for system level 1 specified 60 seconds.
  4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
  5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
  6. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
  7. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
    - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
    - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.4 FUEL OIL STORAGE Tanks

- A. Comply with NFPA 30.
- B. Sub-base Mounted Day Tank: Comply with UL 142, Unit mounted, factory-fabricated fuel tank assembly.

2.5 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.
- B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.
- C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
- D. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
  - 1. AC voltmeter.
  - 2. AC ammeter.
  - 3. AC frequency meter.
  - 4. DC voltmeter (alternator battery charging).
  - 5. Engine-coolant temperature gage.
  - 6. Engine lubricating-oil pressure gage.
  - 7. Running-time meter.
  - 8. Ammeter-voltmeter, phase-selector switch(es).
  - 9. Generator-voltage adjusting rheostat.
  - 10. Fuel tank derangement alarm.
  - 11. Fuel tank high-level shutdown of fuel supply alarm.
  - 12. Generator overload.
- E. Indicating and Protective Devices and Controls:
  - 1. AC voltmeter.
  - 2. AC ammeter.
  - 3. AC frequency meter.
  - 4. DC voltmeter (alternator battery charging).
  - 5. Engine-coolant temperature gage.

6. Engine lubricating-oil pressure gage.
  7. Running-time meter.
  8. Ammeter-voltmeter, phase-selector switch(es).
  9. Generator-voltage adjusting rheostat.
  10. Start-stop switch.
  11. Overspeed shutdown device.
  12. Coolant high-temperature shutdown device.
  13. Coolant low-level shutdown device.
  14. Oil low-pressure shutdown device.
  15. Generator overload.
- F. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- G. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
1. Overcrank shutdown.
  2. Coolant low-temperature alarm.
  3. Control switch not in auto position.
  4. Battery-charger malfunction alarm.
  5. Battery low-voltage alarm.
- H. Common Remote Audible Alarm: Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.
1. Engine high-temperature shutdown.
  2. Lube-oil, low-pressure shutdown.
  3. Overspeed shutdown.
  4. Remote emergency-stop shutdown.
  5. Engine high-temperature pre-alarm.
  6. Lube-oil, low-pressure pre-alarm.
  7. Fuel tank, low-fuel level.
  8. Low coolant level.
- I. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.
- J. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

## 2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
  - 1. Tripping Characteristic: Designed specifically for generator protection.
  - 2. Mounting: Adjacent to or integrated with control and monitoring panel.
    - a. Rating: Provide (3) unit mounted circuit breakers (See drawings for ratings.)
- B. Generator Control: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:
  - 1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
  - 2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
  - 3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
  - 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

## 2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Dripproof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.



1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Sub-transient Reactance: .14 Maximum.

## 2.8 SOUND ATTENUATED LEVEL 2 ENCLOSURE

- A. Description: Vandal-resistant, Sound Attenuated weatherproof steel housing, wind resistant up to 100 mph. Doors shall be lockable and provide adequate access to interior. Instruments and control shall be mounted within enclosure. Maximum Sound Level shall be 73 DBA @ 7 Meters. All Muffler shall be internal.

## 2.9 VIBRATION ISOLATION DEVICES

- A. Seismic Certified Package per IBC.

## 2.10 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

## 2.11 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
  1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set, and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
  1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
  2. Full load run.
  3. Maximum power.
  4. Voltage regulation.
  5. Transient and steady-state governing.
  6. Single-step load pickup.
  7. Safety shutdown.
  8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.

## 2.12 ACCESSORIES

- A. All accessories needed for the proper operation of the generating set shall be furnished. These shall include a critical muffler, flexible exhaust connection with flanges, nuts, bolts, and gasket set, Single Phase Jacket Water Heater, starting batteries, battery cables, battery rack, and five sets of detailed operation and maintenance manuals with parts list.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Install packaged engine generator on 4-inch- high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

### 3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 IDENTIFICATION

- A. Identify system components according to Division 23 Section "Identification for HVAC Piping and Equipment" and Division 26 Section "Identification for Electrical Systems."

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
  - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
  - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
    - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    - c. Verify acceptance of charge for each element of the battery after discharge.
    - d. Verify that measurements are within manufacturer's specifications.
  - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
  - 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
  - 6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
  - 7. Exhaust Emissions Test: Comply with applicable government test criteria.
  - 8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases and verify that performance is as specified.
- D. Coordinate tests with tests for transfer switches and run them concurrently.

- E. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- F. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- I. Remove and replace malfunctioning units and retest as specified above.
- J. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- L. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.
  - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
  - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 263213

## SECTION 263600 – 600 VOLT AUTOMATIC TRANSFER SWITCHES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes transfer switches rated 600 V and less, including the following:
  - 1. Automatic transfer switches
- B. Related Sections include the following:
  - 1. Division 26 Section “Generator Sets”

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
  - 1. Technical data on all major components of all transfer switches and other products described in this section. Data is required for the transfer switch mechanism, control system, cabinet, and protective devices specifically listed for use with each transfer switch. Include steady state and fault current ratings, weights, operating characteristics, and furnished specialties and accessories.
  - 2. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
  - 1. Dimensioned outline drawings of assembly, including elevations, sections, and details including minimal clearances, conductor entry provisions, gutter space, installed features and devices and material lists for each switch specified.
  - 2. Internal electrical wiring and control drawings.
  - 3. Interconnection wiring diagrams, showing recommended conduit runs and point-to-point terminal connections to generator set.
  - 4. Installation and mounting instructions, including information for proper installation of equipment to meet seismic requirements.
- C. Manufacturer and Supplier Qualification Data

1. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
  2. The manufacturer of this equipment shall have produced similar equipment for a minimum period of 10 years. When requested, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
  3. The generator set manufacturer shall supply, warrant, and service the transfer switches. The supplier shall maintain a service location within 50 miles of the project site.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Features and operating sequences, both automatic and manual.
  2. List of all factory settings of relays, timers and protective devices; provide setting and calibration instructions where applicable.
- E. Warranty documents demonstrating compliance with the project's contract requirements.
- 1.4 QUALITY ASSURANCE
- A. Only approved bidders shall supply equipment provided under this contract.
- 1.) Cummins Power Generation – OTEC
- B. Manufacturer Qualifications: The equipment supplier shall maintain a service center capable of providing training, parts, maintenance and emergency repairs to equipment, including transfer switch generator sets and remote monitoring equipment (if applicable) at the site within a response period of less than (eight hours) from time of notification.
1. The transfer switch shall be serviced by technicians employed by, and specially trained and certified by, the generator set supplier and the supplier shall have a service organization that is factory-certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
  2. Submit names, experience level, training certifications, and locations for technicians that will be responsible for servicing equipment at this site.
  3. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.
- C. Source Limitations: All transfer switches are to be obtained through one source from a single manufacturer. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for products provided.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked as suitable for use in emergency, legally required or optional standby use as appropriate for the connected load.

- E. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:
1. Transfer switches and enclosures shall be UL 1008 listed and labeled as suitable for use in emergency, legally required, and optional standby applications.
  2. NFPA 70, National Electrical Code. Equipment shall be suitable for use in systems in compliance with Articles 700, 701 and 702.
  3. Comply with NEMA ICS 10-1993 AC Automatic Transfer Switches
  4. IBC 2006 – The transfer switch(es) shall be prototype-tested and third-party certified to comply with the requirements of IBC group III or IV, Category D/F. The equipment shall be shipped with the installation instructions necessary to attain installation compliance
  5. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
  6. EN55011, Class B Radiated Emissions and Class B Conducted Emissions
  7. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity
  8. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity
  9. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity
  10. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity
  11. IEC 1000-4-6 Conducted Field Immunity
  12. IEC 1000-4-11 Voltage Dip Immunity
  13. IEEE 62.41, AC Voltage Surge Immunity
  14. IEEE 62.45, AC Voltage Surge Testing
- F. Comply with NFPA 110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems, regardless of the actual circuit level.
- G. The manufacturer shall warrant the material and workmanship of the transfer switch equipment for a minimum of one 2 years from registered commissioning and start-up.
- H. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, and etc. during the minimum noted warranty period described above.

#### 1.5 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
1. Notify (Architect/Construction Manager/Owner) no fewer than (insert appropriate number) days in advance of proposed interruption of electrical service.
  2. Do not proceed with interruption of electrical service without (Architect/Construction Manager/Owner's) written permission.
  3. Do not energize any new service or distribution equipment without notification and permission of the (Architect/Construction Manager/Owner).

## 1.6 COORDINATION

- A. Size and location of concrete bases and anchor bolt inserts shall be coordinated. Concrete, reinforcement and formwork must meet the requirements specified in Division 03. See section 3.1 for additional information on installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cummins Power Generation
  - 2. ASCO 7000 Series
  - 3. Substitutions require 10 day prior approval
- B. Equipment specifications for this Project are based on automatic transfer switches manufactured by Cummins Power Generation. Switches manufactured by Russelectric or ASCO that meet the requirement of this specification are acceptable, if approved not less than two weeks before scheduled bid date. Proposals must include a line-by-line compliance statement based on this specification.
- C. Transfer switches utilizing molded case circuit breakers do not meet the requirements of this specification and will not be accepted.

### 2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Provide transfer switches in the number and ratings that are shown on the drawings. Indicated Current Ratings: Apply as defined in UL 1008 and CSA for continuous loading and total system transfer.
- B. Fault-Current Closing and Withstand Ratings (WCR): UL 1008 and CSA WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test.
- C. Solid-State Controls: All settings should be accurate to +/- 2% or better over an operating temperature range of - 40 to + 60 degrees C (- 40 to + 140 degrees F).
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operator mechanism, mechanically and electrically interlocked in both directions (except that mechanical interlock is not required for closed transition switches).
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  - 1. Switches using molded-case switches or circuit breakers, or insulated case circuit breaker components are not acceptable.



2. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.
  3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
  4. Contacts shall be operated by a high-speed electrical mechanism that causes contacts to open or close within three electrical cycles from signal.
  5. The transfer switch operation shall include the ability to switch to an open position (both sources disconnected) for the purpose of load shedding from the generator set.
  6. The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical but must be coordinated with control function.
  7. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.
  8. The transfer switch shall include the mechanical and control provisions necessary to allow the device to be field-configured for operating speed. Transfer switch operation with motor loads shall be as is recommended in NEMA MG1.
    - a. Phase angle monitoring/timing equipment is not an acceptable substitute for this functionality
  9. Transfer switches designated on the drawings as “3-pole” shall have a full current-rated neutral bar with lugs.
  10. Transfer switches designated on the drawings as “service entrance” switches shall meet the requirements of section 2.7 of this specification.
- G. Factory wiring: Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism
- H. Terminals: Terminals shall be pressure type and appropriate for all field wiring. Terminal arrangement and cabinet space must be such that feeder conductors can enter from the top, side or bottom of the switch, at the installer’s discretion. Control wiring shall be equipped with suitable lugs, for connection to terminal strips.
- I. Enclosures: All enclosures shall be third-party certified for compliance to NEMA ICS 6 and UL 508 or CSA, unless otherwise indicated:
1. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70 regardless of the direction from which the conduit enters the enclosure.
  2. Exterior cabinet doors shall provide complete protection for the system’s internal components. Doors must have permanently mounted key-type latches. Bolted covers or doors are not acceptable.
  3. Transfer switches shall be provided in enclosures that are third party certified for their intended environment per NEMA requirements.
    - a. Transfer switches mounted in a controlled indoor environment shall be provided in NEMA Type 1 enclosures (IEC type IP30).

## 2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with requirements for Level 1 equipment according to NFPA 110.
- B. Indicated current ratings:
  - 1. ATS's shall be 277/480 3 phase, 4 wire, 4 pole or as indicated on the project drawings. See drawings for equipment withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
  - 2. Main contacts shall be rated for 600 VAC minimum.
  - 3. Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C (-40 to +140 degrees F), relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000 meters).
- C. Manual Switch Operation: The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function
- D. Relay Signal: Control shall include provisions for addition of a pre-transfer relay signal, adjustable from 0 to 60 seconds, to be provided if necessary, for elevator operation, based on equipment provided for the project.
- E. Control: Transfer switch control shall be provided with necessary equipment and software to communicate with the genset control, other transfer switches, remote annunciation equipment, and other devices over a high speed control network.
- F. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.
- G. The transfer switch physically located closest to the generator and not more than 50 ft (15 meters) away, except those served by generator paralleling equipment, shall be provided with a battery charger suitable for the requirements of the application and in compliance with NFPA 110 requirements for Level 1 systems. If no transfer switch is located within this distance, a battery charger shall be installed on the generator set.
- H. Automatic Transfer Switch Control Features
  - 1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600 VAC. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
  - 2. All transfer switch sensing shall be configurable from an operator panel or from a Windows XP or later PC-based service tool. Designs utilizing DIP switches or other electromechanical devices are not acceptable.
  - 3. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.
  - 4. The transfer switch shall provide a relay contact signal prior to transfer or re-transfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.

5. The control system shall be designed, and prototype tested for operation in ambient temperatures from - 40 degrees C to + 60 degrees C (- 40 to +140 degrees F). It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
  6. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
- I. Transfer Switch Control Panel: The transfer switch shall have a microprocessor-based control with a sealed membrane panel incorporating pushbuttons for operator-controlled functions, and LED lamps for system status indicators. The panel shall also include an alphanumeric display for detailed system information. Panel display and indicating lamps shall include permanent labels.
1. The indicator panel LEDs shall display:
    - a. Which source the load is connected to (Source 1 or Source 2)
    - b. Which source, or sources, are available.
    - c. When switch is not set for automatic operation, because the control is disabled, or the bypass switch is in use
    - d. When the switch is in test/exercise mode
  2. The indicator shall have pushbuttons that allow the operator to activate the following functions:
    - a. Activate pre-programmed test sequence
    - b. Override programmed delays, and immediately go to the next operation
    - c. Reset the control by clearing any faults
    - d. Test all of the LEDs by lighting them simultaneously
  3. The panel shall allow the operator to view and make adjustments:
    - a. Set nominal voltage and frequency for the transfer switch
    - b. Adjust voltage and frequency sensor operation set points
    - c. Set up time clock functions
    - d. Enable or disable control functions including program transition
- J. Control Functions: Functions managed by the control shall include:
1. Software adjustable time delays:
    - a. Engine start (prevents nuisance genset starts in the event of momentary power fluctuation): 0 to 120 seconds (default 3 sec)
    - b. Transfer normal to emergency (allows genset to stabilize before load is transferred): 0 to 120 seconds (default 3 sec)
    - c. Re-transfer emergency to normal (allows utility to stabilize before load is transferred from genset): 0 to 30 minutes (default 3 sec)
    - d. Engine cooldown: 0 to 30 minutes (default 10 min)
    - e. Programmed transition: 0 to 60 seconds (default 3 sec)
  2. Undervoltage sensing: three-phase normal, three-phase emergency source.

- a. Pickup: 85 to 98% of nominal voltage (default 90%)
  - b. Dropout: 75 to 98% of nominal voltage (default 90%)
  - c. Dropout time delay: 0.1 to 1.0 seconds (default 0.5 sec)
  - d. Accurate to within +/- 1% of nominal voltage
3. Over-voltage sensing: three-phase normal, three-phase emergency source.
  - a. Pickup: 95 to 99% of dropout setting (default 95%)
  - b. Dropout: 105 to 135% of nominal voltage (default 110%)
  - c. Dropout time delay: 0.5 to 120 seconds (default 3 sec)
  - d. Accurate to within +/- 1% of nominal voltage
4. Over/under frequency sensing:
  - a. Pickup: +/- 5 to +/-20% of nominal frequency (default 10%)
  - b. Dropout: +/-1% beyond pickup (default 1%)
  - c. Dropout time delay: 0.1 to 15.0 seconds (default 5 sec)
  - d. Accurate to within +/- 0.2%
5. Voltage imbalance sensing:
  - a. Dropout: 2 to 10% (default 4%)
  - b. Pickup: 90% of dropout
  - c. Time delay: 2.0 to 20 seconds (default 5 sec)
6. Phase rotation sensing:
  - a. Time delay: 100 msec
7. Loss of single-phase detection:
  - a. Time delay: 100 msec
- K. Control features shall include:
  1. Programmable genset exerciser: A field-programmable control shall periodically start the generator, transfer the load to generator for a preset time, then re-transfer and shut down the generator after a preset cool-down period.
    - a. Push-button programming control shall have a selection of eight different schedules for exercising generator, with or without load.
  2. In event of a loss of power to the control, all control settings, real-time clock setting and the engine start-time delay setting will be retained.
  3. The system continuously logs information including the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. An event recorder stores information, including time and date-stamp, for up to 50 events.
  4. Transfer Override Switch: Overrides automatic re-transfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light to indicate override status.

L. Control Interface

1. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
2. The transfer switch shall be provided with a network communication card and configured to allow network-based communication with the transfer switch and other network system components, including the generator set(s) provided for the Project.
3. Unassigned Auxiliary Contacts: Two normally open, 1-pole, double-throw contacts for each switch position, rated 10A at 240 VAC.

M. Engine Starting Contacts

1. One isolated and normally closed, and one isolated and normally open; rated 10A at 32 VDC minimum.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Floor-Mounting Switch: Anchor to floor by bolting.
  1. Floor-mounted transfer switches (except drawout switches supported by wheeled carriages, which must be rolled out at floor level) shall be mounted on concrete bases complying with the following requirements:
    - a. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Identify components according to Division 26 Section "Identification for Electrical Systems."
- D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner, if necessary, to accommodate required wiring.
- B. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

- C. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.3 SOURCE QUALITY CONTROL

- A. Prior to shipping, factory shall test and inspect components, assembled switches, and associated equipment to ensure proper operation.
- B. Factory shall check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements.
- C. Factory shall perform dielectric strength test complying with NEMA ICS 1.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: The supplier of the transfer switch(es) and associated equipment shall inspect, test, and adjust components, assemblies, and equipment installations, including connections, and report results in writing.
- B. Manufacturer's representative shall perform tests and inspections and prepare test reports.
- C. After installing equipment and after electrical circuitry has been energized, installer shall test for compliance with requirements.
  - 1. Perform recommended installation tests as recommended in manufacturer's installation and service manuals.
  - 2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch.
    - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    - b. Verify time-delay settings.
    - c. Verify that the transfer switch is accurately metering AC voltage and current (when provided).
    - d. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
  - 3. Ground-Fault Tests (if integral to transfer switch): Coordinate with testing of ground-fault protective devices for power delivery from both sources.
    - a. Verify grounding connections and locations and ratings of sensors.

- D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, contractor shall perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
  2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 DEMONSTRATION

- A. After generator set installation, the generator and transfer switch supplier shall conduct a complete operation, basic maintenance, and emergency service seminar covering generator set and transfer switch equipment, for up to 10 people employed by the Owner.
1. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures.
  2. The class duration shall be at least 8 hours in length and include practical operation with the installed equipment.

END OF SECTION 263600

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## SECTION 264313 - SURGE PROTECTIVE DEVICES

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchboards and panelboards. Refer to related sections for surge requirements in:

#### 1.2 RELATED SECTIONS

- A. Section 262416 – Panelboards
- B. Section 262413 – Switchboards – Low Voltage

#### 1.3 REFERENCES

- A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3<sup>rd</sup> Edition).

#### 1.4 SUBMITTALS – For Review/Approval

- A. The following information shall be submitted to the Engineer:
  - 1. Provide verification that the SPD complies with the required ANSI/UL 1449 3<sup>rd</sup> Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current ( $I_n$ ).
  - 2. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.
- B. Where applicable the following additional information shall be submitted to the engineer:
  - 1. Descriptive bulletins
  - 2. Product sheets

#### 1.5 SUBMITTALS – FOR CONSTRUCTION

- A. The following information shall be submitted for record purposes:
  - 1. Final as-built drawings and information for items listed in Section 1.4 and shall incorporate all changes made during the manufacturing process.

## 1.6 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

## 1.8 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be provided with each SPD shipped.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Eaton Cutler-Hammer
- B. Square D
- C. GE
- D. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

### 2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

A. Electrical Requirements

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 115% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

Configuration	Protection Modes			
	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

5. Nominal Discharge Current ( $I_n$ ) – All SPDs applied to the distribution system shall have a 20kA  $I_n$  rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an  $I_n$  less than 20kA shall be rejected.
6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

MODES	208Y/120	480Y/277
L-N; L-G; N-G	700	1200
L-L	1200	2000

B. SPD Design

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.

5. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
  - a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
    - 1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
    - 2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
    - 3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
  - b. Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
  - c. Audible Alarm and Silence Button – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
6. Overcurrent Protection
  - a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
7. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.
8. Safety Requirements
  - a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
  - b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

- c. Sidemount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Sidemount SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

## 2.3 SYSTEM APPLICATION

- A. The SPD applications covered under this section include distribution and branch panel locations and switchboard assemblies as indicated on drawings. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
- B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
CATEGORY	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA

- C. SPD Type - All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

## 2.4 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

- A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
  - 1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
  - 2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
  - 3. The panelboard shall be capable of re-energizing upon removal of the SPD.
  - 4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.
  - 5. The SPD where noted on drawings or in schedules shall be included and mounted within the panelboard by the manufacturer of the panelboard.
  - 6. The SPD shall be of the same manufacturer as the panelboard.
  - 7. The complete panelboard including the SPD shall be UL67 listed.

## 2.5 ENCLOSURES

- A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:
  - 1. NEMA 1 – Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. NOT APPLICABLE TO THIS SECTION.

### 3.2 FACTORY TESTING

- A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

### 3.3 INSTALLATION

- A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

### 3.4 WARRANTY

- A. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION 264313

## SECTION 265100 – INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Section includes, but is not necessarily limited to, the furnishing and installation of all lighting as indicated on the Drawings, as specified herein, and as necessary for the proper and complete performance of the work.
- B. Major items:
  - 1. Interior lighting fixtures
  - 2. Emergency lighting
  - 3. Exit lighting
  - 4. Lamps installed in fixtures
  - 5. Adequate fixture support systems.

#### 1.2 STANDARDS

- A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
  - 1. ANSI-UL Standards
    - a. 924 – Emergency Lighting and Power Equipment
    - b. 935 – Fluorescent Lamp Ballasts
    - c. 1570 – Fluorescent Lighting Fixtures
    - d. 1572 – Incandescent Lighting Fixtures
    - e. 1572 – High Intensity Discharge Fixtures
  - 2. NFPA
    - a. 70 – NEC
    - b. 101 – Life Safety

#### 1.3 FIXTURE SCHEDULE

- A. No substitutions will be accepted after bids are received. The lighting equipment specified herein has been carefully chosen for its ability to meet luminous performance requirements of this project. Substitutions in all likelihood will be unable to meet all of the same criteria as specified equipment. No exceptions.

- B. When only one manufacturer is listed within the description of the luminaire, the design engineering of architectural aesthetics will not allow substitution of another manufacturer. The contractor shall provide a separate list of unit costs for these luminaires with shop drawings. Shop drawings will not be reviewed without unit cost information.
- C. When more than one manufacturer is listed within the description of the luminaire, the design engineering or architectural aesthetics will allow the Contractor to choose one of the manufacturers listed, but no other substitution will be acceptable.
- D. When one or more manufacturers and the words "or equivalent" appear within the fixture description, the Contractor may elect to submit to Engineer a substitute fixture for review. All submittals must be made within 14 days prior to the bid date to provide ample time for review and to issue an addendum incorporating the substitution.
- E. Substitution submittals shall consist of a physical description, dimensioned drawing and complete photometric and electric data of the proposed lamp and luminaire. Working samples of lamp and luminaire substitutions must also be supplied for visual check of finish and operating characteristics. Photometric reports must list the actual candela values for the luminaire's distribution in at least three planes. Candela curves, footcandle and lumen tables and iso-footcandle contours are not acceptable. No substitutions will be considered without compliance with the paragraph. Contractor will be responsible for all cost, (engineering time, manufacturer's costs, distributor costs) incurred to replace equipment not approved if substitutions are made by the distributor, manufacturers representative, or subcontractor.
- F. Once Bids, Shop Drawings are approved, all lighting is to be ordered in a timely manner. The Contractor is then to inform the Engineer immediately, in writing, the date when equipment orders are completed, and delivery scheduled.

#### 1.4 SUBMITTALS

- A. Submit shop drawings and manufacturers' data for the following items in accordance with the conditions of the contract and as specified below.
  - 1. Major luminaires and special luminaires shall show full size cross sections. Indicate finished dimensions, metal thicknesses, and materials.
  - 2. Show mounting details, including hung ceiling construction.
  - 3. Indicate type of ballast and manufacturer and ballast quantity and location. Include information as to power factor, input watts, and ballast factor.
  - 4. Shop drawings shall include a complete listing of all luminaires on a single sheet. This listing shall contain the luminaire type, manufacturer's catalog number, applied voltage, lamps and ballasts.
  - 5. Submit manufacturer's fixtures and accessories Shop Drawings and data in booklet form, including rough-in dimensions, instructions for installation and maintenance.

#### 1.5 PROTECTION

- A. Protect lighting fixtures and work against dirt, water or mechanical damage before, during, and after installation. Damage to fixtures prior to final acceptance shall be repaired or replaced at no cost to the Owner.



## PART 2 - PRODUCTS

### 2.1 MATERIALS AND FIXTURES

#### A. General

1. Provide all lighting fixtures in accordance with Lighting Fixture Schedule and as indicated and required on Drawings.
2. Fixture catalog numbers only indicates type and style. Provide each fixture complete with proper fixture trim, levelers, mounting brackets, flanges, plaster rings, glassware and accessories for complete installation as required for type of ceiling and room finish schedules.
3. All plastic diffusers used in lighting fixtures shall be manufactured of 100 percent virgin acrylic plastic.
4. Provide approved fireproof enclosures UL rated (UL 0529) where recessed in fire rated ceilings.
5. Provide gaskets as required to prevent light spill between frames and ceilings.
6. Provide "wet" labels on all fixtures installed outdoors or in moist areas.
7. Provide continuity of ground on all fixtures used as raceways and mounted end to end.
8. All metal parts to be chemically treated with a rust resistant phosphatized solution, reflecting surfaces to have a factor of minimum 90%.
9. Provide luminaires, completely factory-assembled and wired and equipped with necessary sockets, ballasts, wiring, shielding, reflectors, channels, lenses, etc., and deliver to job ready for installation.
10. Parabolic Luminaire Care: Parabolic luminaires to be installed with Mylar cover over louvers. Cover shall be UL listed for temporary lighting. Upon completion of work, remove Mylar cover with white glove and blow clean reflectors.
11. Finish: Porcelain or baked enamel finish matte white on interiors with minimum test reflectance of 90% matte white finish or as specified in visible exterior. Thoroughly clean base metal and bonderize after fabrication.
12. Luminaire Wiring: Minimum individual luminaire wiring – number 18 gauge with insulation with rated operating temperature of 105 degrees Centigrade or higher. Terminate wiring for recessed luminaires, except fluorescent units, in an external splice box.
13. Where utilized as raceway, luminaires shall be suitable for use as raceways. Provide feed through splice boxes where necessary. Wiring shall be rated for 90 degrees Centigrade.

#### B. Emergency Lighting Ballast

1. Emergency lighting systems shall be as indicated in Drawings, complete with all equipment, including fixtures, lamps, batteries, conduit, boxes and wiring.
2. This equipment is to provide instantaneous emergency lighting in the event of a power failure by means of batteries controlled by solid state controls.

#### C. Exit Lighting

1. Exit lighting system shall be as indicated on Drawings.
2. Equipment shall be complete with lamps.
3. Where indicated as such, provide battery pack and charger for illumination under power failure conditions.

4. Equipment shall meet BOCA, OSHA, NFPA and NEC illumination standards.

## 2.2 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: ½ inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, ½ inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

## PART 3 - EXECUTION

### 3.1 INSPECTION AND PREPARATION

- A. General
  1. Install outlets, surface mounted, recessed or semi-recessed fixtures to maintain the alignment, spacings, layout and general arrangements indicated in the Drawings. Obtain approval of Engineer for all changes in layout required to avoid interferences with other trades.
- B. Coordination
  1. Work incorporating with ceiling trades in locating and framing recessed fixtures in acoustical tile pattern or grid system to conform to layout.
  2. Inform affected trades of the location and framing details necessary for the installation of flush fixtures and deliver all framing rings of these fixtures that become a part of the ceiling construction.
  3. Before equipment is ordered, electrical contractor to review luminaire and ceiling mechanical compatibility in each area and verify luminaire on the drawings. Contractor shall be responsible for all fixture quantities, lengths and clearances required and shall inform the ARCHITECT of the job conditions at variance with the fixture(s) specified or detailed which affect installation or location. (All stages of installation.)
  4. Mechanical and electrical contractors are to review and coordinate lighting locations in relationship to mechanical systems to minimize conflicts prior to installation. Electrical contractor is to submit a written memo with minutes of these meetings to both the Architect and Engineer.
  5. This contractor is responsible for coordinating the characteristics and the U.L. labeling of the luminaires and their components with the ambient conditions, which will exist when the luminaires are installed. No extra compensation will be permitted for failure to coordinate the luminaires with their ambient conditions.
- C. Mounting and Supports

1. Install luminaires in mechanical and unfinished areas after ductwork and piping installation. Locate fixtures 8 feet 6 inches above the floor, or at suitable locations within space on walls but not lower than 7'-0" AFF. Where mounted lower than 8'-6" luminaires shall be protected by an approved wire guard.
2. Where luminaires are surface mounted, they shall be labeled for such and a minimum of one-half (1/2) inch air space and shall be maintained between top of luminaire and mounting surface by an approved means.
3. Pendant mounted units shall comply with the following:
  - a. Where luminaires are mounted in a continuous row, luminaires, eight feet in length shall have stems placed within 2'-0" of end of fixture. Stems shall be spaced symmetrically. A fixture, four feet or three feet in length, placed in a row, shall have a stem connected to center luminaire.
  - b. Individual luminaires, four feet in length, shall have two stems placed approximately 3 inches from each end.
  - c. Individual luminaire, three feet in length, shall have dual stems and a single canopy.
  - d. Each stem shall have a brass or steel swivel or other self-aligning device of type approved by the Architect/Engineer.
4. Where luminaires are mounted on surface-mounted outlet boxes in surface mounted conduit runs, this Contractor shall furnish and install a luminaire canopy sufficiently deep to permit exposed conduits to pass through. Canopy shall have proper openings cut by luminaire manufacturer through which conduits may pass. Submit sample of canopy for approval before installation.
5. Prior to final payment, this contractor shall clean all luminaires. He shall also touch up all scratch marks, etc. in an approved manner.
6. Provide a minimum of two support points for all surface, pendant or recessed mounted luminaires. The supports shall be tied to the building structural system. The support points shall be totally independent of the ceiling system.
7. Recessed luminaires to be installed in metal panel or acoustic modular ceilings shall be modified as required to fit into openings in ceiling construction. This contractor shall coordinate and verify this work with the General Construction Contractor. Shop Drawings showing details shall be submitted for approval.
8. All luminaires in hung ceilings are to be installed with earthquake clips.

D. Emergency Systems Raceway and Hook-up

1. Circuit wiring for the emergency systems shall be installed in separate raceway and kept entirely independent of all other wiring and equipment.

3.2 ADJUSTING AND CLEANING

A. At project completion, before final approval:

1. Aim adjustable fixtures as directed and observe and adjust at night as required.
2. Clean interior of all fixtures, all lenses and lamps.

END OF SECTION 265100

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## SECTION 265200 - SOLID STATE LIGHTING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Section includes, but is not necessarily limited to, the furnishing and installation of solid state lighting (SSL) Luminaires (herein referred to as Luminaires) applied to the illumination of interior and exterior spaces. Luminaires shall be listed in accordance with national recognized testing laboratories (NETLs) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA).

#### 1.2 RELATED DOCUMENTS

- A. Specification Section 260923 – "Lighting Control System".
- B. Specification Section 265100 – "Interior Lighting".

#### 1.3 DEFINITIONS AND STANDARDS

- A. The terms and standards used or referenced herein are defined as follows:

ANSI-C78.377	American National Standard for Electric Lamps – Specifications for the Chromaticity of Solid State Lighting (SSL) Products.
ANSI-C82.11	American National Standard for Lamp Ballasts – High Frequency Fluorescent Lamp Ballasts.
ANSI-C82.SSL1	SSL Drivers (in ANSI development)
CALiPER	Commercially Available LED Product Evaluation and Reporting 'A' US DOE program for the testing and monitoring of commercially available LED Luminaires and lights.
CCT	Correlated Color Temperature: Visible light characteristic of comparing a light source to a theoretical, heated black body radiator; measured in Kelvin.
Cd	Candela: Unit of measurement of light intensity.
Chromaticity	The property of color of light.
fc	foot-candle. Unit of illuminance.
IEC-EN-61000-6-3	International Electrotechnical Commission – Electromagnetic Compatibility (EMC) Generic Standards – Emission Standard for residential, commercial and light-industrial environments.
IEEE C62.41.1	IEEE Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits.
IEEE C62.41.2	IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits.
IES-LM-79-08	Illuminating Engineering Society – Approved Methods: Electrical and Photometric Measurements of Solid-State Lighting Products.

IES-LM-80-08	IES LM-80-08	Measuring Lumen Maintenance of LED Light Sources.
IES LM-82-12	IES LM-82-12	Measuring Lumen Maintenance of LED Light Sources.
IES-TM-21	IES-TM-21	Method for determining an LED luminaire or integral replacement lamp's expected operating life, based on initial performance data collected per IES-LM-80.
L80	L80	The extrapolated life in hours of the luminaire when the luminous output depreciates 20 percent from initial values.
LED	LED	Light Emitting Diode.
METS	METS	Material Engineering and Testing Services of the Translab.
NEMA	NEMA	National Electrical Manufacturers Association.
NVLAP	NVLAP	National Voluntary Laboratory Accreditation Program. A program under the US DOE to accredit independent testing laboratories to qualify.
Power Factor	Power Factor	The ratio of the real power component to the total (complex) power component.
Rated power	Rated power	Power consumption that the luminaire was designed and tested for at ambient temperature.
SPD	SPD	Surge Protection Device. A subsystem or component(s) that can protect the unit against short duration voltage and current surges.
SSL	SSL	Solid-State Lighting.
THD	THD	Total Harmonic Distortion. The amount of higher frequency power on the power line.

B. Except as herein specified or as indicated on the Drawings, the work of this section shall comply with the following:

1. ANSI-UL Standards
  - a. 924 – Emergency Lighting and Power Equipment
  - b. C78.377 – Chromacity of Solid State Lighting (SSL) Products
  - c. C82.11 – High Frequency Fluorescent Lamp Ballasts
  - d. C82.SSL1 – SSL Drivers
2. IEC
  - a. EN-61000-6-3 – EMC Emission Standards
3. NFPA
  - a. 70-NEC
  - b. 101-Life Safety
4. Standards as listed and referenced in this Specification.

- C. All LED Luminaires shall have a CRI of at least 80, an estimated life of at least 50,000 hours at 70% lumen maintenance and shall include a minimum 5-year warranty on the entire luminaire including the driver. The luminaire and LEDs shall have been tested in accordance with LM-79 and LM-80.

#### 1.4 FIXTURE SCHEDULE

- A. No substitutions other than the equal manufacturers listed on the light fixture schedule will be accepted, unless otherwise approved in writing by the Engineer. The lighting equipment specified herein has been carefully chosen for its ability to meet luminous performance requirements of this project. Substitutions in all likelihood will be unable to meet all of the same criteria as specified equipment.
- B. Once Bids and Shop Drawings are approved, all lighting is to be ordered according to construction schedule and lead times. The Contractor is then to inform the Engineer immediately, in writing, the date when equipment orders are completed, and delivery scheduled.

#### 1.5 SUBMITTALS

- A. Submit shop drawings and manufacturers' data for the following items in accordance with the conditions of the contract and as specified below.
  - 1. Shop drawings shall be submitted with product datasheets that include the following information:
    - a. General device descriptions
    - b. Dimensions
    - c. Wiring details
    - d. Nomenclature
    - e. Operating temperature range
    - f. System efficacy
    - g. Rated life
    - h. Rated output
    - i. Input wattage
    - j. Inrush current
    - k. THD
    - l. Power factor
    - m. Warranty
    - n. CCT
    - o. The rated life
    - p. Lumen outputThis information shall be provided for the actual lumen package and driver combination specified. Provide information regarding the effects of temperature on the rated life and lumen output. If applicable, the submittal shall also include the US Department of Energy Lighting Facts label.
  - 2. Major luminaires and special luminaires shall show full size cross sections. Indicate finished dimensions, metal thicknesses, and materials.

3. Show mounting details, including hung ceiling construction.
4. Shop drawings shall include a complete listing of all luminaires on a single sheet. This listing shall contain the luminaire type, manufacturer's catalog number, applied voltage, and wattage.
5. Submit manufacturer's fixtures and accessories Shop Drawings and data in booklet form, including rough-in dimensions, instructions for installation and maintenance.

#### 1.6 WARRANTY

- A. The manufacturer shall provide a warranty against loss of performance and defects in materials, finishes, and workmanship for the Luminaires and all components for a minimum period of 5 years after acceptance of the Luminaires. Replacement Luminaires shall be provided promptly after receipt of Luminaires that have failed at no cost to the customer. All warranty documentation shall be provided to customer prior to random sample testing.
- B. Failure of the LED light source shall be defined as failure or negligible output of 10% or more individual LEDs within the LED array, bar, etc.

#### 1.7 PROTECTION

- A. Protect lighting fixtures and work against dirt, water or mechanical damage before, during, and after installation. Damage to fixtures prior to final acceptance shall be repaired or replaced at no cost to the Owner.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND FIXTURES

##### A. General

1. Provide all lighting fixtures in accordance with Lighting Fixture Schedule and as indicated and required on Drawings.
2. Fixture catalog numbers only indicate type and style. Provide each fixture complete with proper fixture trim, levelers, mounting brackets, flanges, plaster rings, glassware and accessories for complete installation as required for type of ceiling and room finish schedules.
3. All plastic diffusers used in lighting fixtures shall be manufactured of 100 percent virgin acrylic plastic, polycarbonate, or as otherwise noted.
4. Provide approved fireproof enclosures UL rated (UL 0529) where recessed in fire rated ceilings.
5. Provide gaskets as required to prevent light spill between frames and ceilings.
6. Provide "wet" labels on all fixtures installed outdoors or in moist areas.
7. Provide continuity of ground on all fixtures used as raceways and mounted end to end.
8. All metal parts to be chemically treated with a rust resistant phosphatized solution, internal components and reflecting surfaces to have a factor of minimum 90%.



9. Provide luminaires, completely factory-assembled and wired and equipped with necessary light sources, drivers, wiring, shielding, reflectors, channels, lenses, etc., and deliver to job ready for installation.
10. Luminaire Reflector Care: Luminaires with Alzak reflectors shall be installed with Mylar cover over reflectors. Cover shall be UL listed for temporary lighting. Upon completion of work, remove Mylar cover with white glove and blow clean reflectors.
11. Finish: Porcelain or baked enamel finish matte white on interiors with minimum test reflectance of 90% matte white finish or as specified in visible exterior. Thoroughly clean base metal and bonderize after fabrication.
12. Where utilized as raceway, luminaires shall be suitable for use as raceways. Provide feed through splice boxes where necessary. Wiring shall be rated for 90 degrees Centigrade.

B. Luminaires

1. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply). If required, components such as the LED array and driver shall be modular and replaceable without removing the luminaire.
2. Each luminaire shall be rated for a minimum operational life as specified on lighting fixture schedule or per basis of design luminaire, as defined by IES LM-80 and TM-21.
3. Each luminaire shall be designed to operate at an average operating temperature of 25°C.
  - a. The typical operating temperature range shall be -10°C to +25°C, unless otherwise specified on lighting fixture schedule and Drawings.
  - b. Some parameters and tests (such as IESNA standard LM-80-08) shall be conducted at different ambient temperatures.
4. Each luminaire shall meet all parameters of this specification throughout the minimum operational life when operated within the rated temperature range.
5. The individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
6. Each luminaire shall be listed with a nationally recognized testing laboratory (including but not limited to UL, CSA, ETL) under UL 1598 and UL 8750, or an equivalent standard from a recognized testing laboratory.

C. LEDs

1. The light source of the luminaires shall consist of LED arrays or bars. If required, the LED arrays or bars shall be removeable.
2. The LEDs shall be either white or RGB, according to the light fixture schedule and Drawings. For luminaires specified with white light, it is not acceptable to provide RGB LEDs mixed to produce white light.
3. Refer to the light fixture schedule and Drawings for the specified correlated color temperature (CCT) of each luminaire.
4. Individual LEDs shall be binned by manufacturer to comply with ANSI C78.377.
5. The LEDs shall be manufactured by Cree, Philips, Toshiba, Osram, Samsung, or Nichia, unless otherwise noted.

D. Drivers

1. The driver or power supply for the luminaire shall be modular and replaceable.

2. The rated life of the driver shall match the rated life of the LEDs and luminaire.
3. In general, the drive current rating of the driver shall be minimized, while still maintaining the required lumen output, to improve luminaire efficiency and life.
4. The driver shall meet the emission standards of IEC EN-61000-6-3 at a minimum. For healthcare or other applications with EMI sensitive equipment, provide drivers that meet more stringent standards as required.

E. Exit Lighting

1. Exit lighting system shall be as indicated on Drawings.
2. Equipment shall be complete with LED light sources.
3. Where indicated as such, provide battery pack and charger with self-diagnostics for illumination under power failure conditions.
4. Equipment shall meet BOCA, OSHA, NFPA and NEC illumination standards.

F. Emergency Lighting

1. Provide GTD or GTD20A transfer devices suitable for use with solid-state lighting (Bodine or approved equal manufacturer) as indicated on drawings, light fixture schedule, and lighting control schedule.

2.2 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: ½ inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, ½ inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

PART 3 - TECHNICAL REQUIREMENTS

3.1 ELECTRICAL

- A. Power Consumption: Maximum power consumption allowed for the luminaire shall be per basis of design light fixture listed on lighting fixture schedule.
- B. Operation Voltage
  1. The luminaire shall operate from a 60 HZ  $\pm$ 3 HZ AC line over a voltage ranging from 277 VAC as specified on the drawings. The fluctuations of line voltage shall have no visible effect on the luminous output.
  2. The standard operating voltages are 277 VAC as shown on drawings.
- C. Current: The inrush current for the luminaire shall be published on the luminaire data sheet and shall be less than that of the basis of design fixture listed on the light fixture schedule.

- D. Power Factor: The luminaire shall have a power factor of 0.90% or greater at all standard operating voltages.
- E. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent at any standard input voltage. The luminaire shall comply with ANSI C82.11, or equivalent ANSI LED Standard C82.SSL1.
- F. Surge Suppression: The luminaire shall include surge protection to withstand high repetition noise and other interference.
  - 1. The surge protection which may reside within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 for Location Category A Low. Where failure does not mean a momentary loss of light during the transient event.
  - 2. Surge protection performance shall be tested per the procedures in ANSI/IEEE C62.45 based on ANSI/IEEE C62.41 definitions for standard and optional waveforms for Location Category A-Low
- G. Operational Performance: The LED circuitry shall prevent perceptible flicker to the unaided eye over the voltage range specified above.
- H. RF Interference: The luminaire and associated on-board circuitry must meet Class A emission limits referred in IEC EN-61000-6-3 and Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.
- I. Dimming: Where dimming is specified on the drawings, the luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100% to 5% of rated lumen output. Dimming shall be controlled by a 0-10V signal, unless otherwise noted or specified.
  - 1. Dimming switches and other control system components shall be compatible with the LED driver type – constant current reduction (CCR) or pulse-width modulation (PWM). The device(s) shall be rated to accommodate full load, as well as inrush current and repetitive peak currents.
  - 2. The luminaire and dimming controls shall produce a smooth change in lumen output, without any visible flicker.
  - 3. The luminaire shall be capable of dimming without any visible change in CCT and color rendition.
- J. Multi-Level Control: Where specified on drawings, the luminaire shall be provided with multiple power supplies, multi-level power supply, or other similar means to facilitate multi-level control of luminaire.
- K. Temperature Range: The luminaire shall have the capability of operating and maintaining rated lumen output and rated life within the temperature range specified on the lighting fixture schedule and Drawings, or within that of the basis of design luminaire if no temperature range is specifically listed.
- L. Lumen Output and Performance

1. The luminaire shall maintain the lumen output specified on the lighting fixture schedule and Drawings, or that of the basis of design luminaire if no minimum lumen output is specifically listed.
  2. The lumen output shall be maintained regardless of ambient temperature fluctuations, within the rated temperature range. The luminaire data sheets shall specify any effect or variation on lumen output from temperature.
  3. The luminaire shall be capable of continuously monitoring system performance to allow for constant lumen management/compensation, if specified in lighting fixture schedule, Drawings, or basis of design luminaire.
  4. The luminaire shall provide a total system efficacy that meets or exceeds that of the basis of design luminaire listed on the light fixture schedule and Drawings.
- M. Rated Life: The luminaire shall have a rated life that meets or exceeds that listed on the lighting fixture schedule and Drawings, or that of the basis of design luminaire if no rated life is specifically listed.

### 3.2 PHOTOMETRIC REQUIREMENTS

#### A. Light Output

1. The minimum initial lumen output of the luminaire exiting the luminaire in the 0-90 degree zone - as measured by IESNA Standard LM-79-08 shall be as specified in the lighting fixture schedule and Drawings, or that of the basis of design luminaire if no lumen output is specifically listed.
2. The lumen output shall not decrease by more than 30% over the minimum operational life (or L70 shall be at least the minimum number of hours specified).
3. The measurements shall be calibrated to standard photopic calibrations.

#### B. Light Color/Quality

1. Corrected Color temperature (CCT) range shall be correlated to chromaticity as defined by the absolute (X,Y) coordinates on the 2-D CIE chromaticity chart.
2. The color rendition index (CRI) shall be 80 or greater for interior applications, and 70 or greater for exterior applications.

### 3.3 THERMAL MANAGEMENT

- A. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.
1. The LED manufacturer's maximum junction temperature for the expected life shall not be exceeded at the average operating ambient.
  2. The LED manufacturer's maximum junction temperature for the catastrophic failure shall not be exceeded at the maximum operating ambient.
  3. The luminaire shall have an UL IC rating, if applicable.
- B. The Driver manufacturer's maximum case temperature shall not be exceeded at the maximum operating ambient. Thermal management shall be passive by design.

1. The use of fans or other mechanical devices shall not be allowed.

### 3.4 PHYSICAL AND MECHANICAL REQUIREMENTS

- A. The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply for the luminaire shall be integral to the unit, unless otherwise specified.
- B. The assembly and manufacturing process for the SSL luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.
- C. The optical assembly of the luminaire shall be constructed so that individual LED images shall not be visible to the occupant.
- D. The electronics/power supply enclosure shall be internal to the SSL luminaire and be accessible per UL requirements.
- E. The circuit board and power supply shall be contained inside the luminaire.
- F. Electrical connections between normal power, driver and LED boards must be modular utilizing a snap fit connector. All electrical components must be easily accessible after installation from the room side and all electrical components must to be able to be replaced without removing the fixture from the ceiling.
- G. For LED retrofit lamps, the weight of the unit shall be in compliance with weight ratings of the lamp sockets/bases.

### 3.5 MATERIALS

- A. Housings shall be fabricated from material indicated on lighting fixture schedule.
- B. If applicable, refractor or lens shall be made from UV inhibited high impact plastic (such as acrylic or polycarbonate) or heat and impact resistant glass.
- C. If applicable, polymeric materials of enclosures containing either the power supply or electronic components of the luminaire shall be made of UL94VO flame retardant materials. The lenses of the luminaire are excluded from this requirement.

### 3.6 LUMINAIRE IDENTIFICATION

- A. Each luminaire shall have the manufacturer's name, trademark, model number, serial number, date of manufacture (month-year), and lot number as identification permanently marked inside the each unit and the outside of each packaging box.
- B. The following operating characteristics shall be permanently marked inside each unit: rated voltage and rated power in Watts and Volt-Ampere.

### 3.7 QUALITY ASSURANCE

- A. The luminaires shall be manufactured in accordance with a manufacturer quality assurance (QA) program. The QA program shall include two types of quality assurance: (1) design quality assurance and (2) production quality assurance. The production quality assurance shall include statistically controlled routine tests to ensure minimum performance levels of the modules built to meet this specification, and a documented process of how problems are to be resolved.
- B. QA process and test results documentation shall be kept on file for a minimum period of seven years.
- C. LED luminaire designs not satisfying design qualification testing and the production quality assurance testing performance requirements described below shall not be labeled, advertised, or sold as conforming to this specification.
- D. Design Qualification Testing
  - 1. Design Qualification Testing shall be performed by a National Voluntary Laboratory Accreditation Program (NVLAP) testing facility. Such testing may be performed by the manufacturer or an independent testing lab hired by the manufacturer on new luminaire designs, and when a major design change has been implemented on an existing design. A major design change is defined as a design change (electrical or physical) which changes any of the performance characteristics of the luminaire, results in a different circuit configuration for the power supply, or changes the layout of the individual LED's in the module.
  - 2. A quantity of two units for each design shall be submitted for Design Qualification Testing.
  - 3. Product submittals shall be accompanied by product specification sheets or other documentation that includes the designed parameters as detailed in this specification. These parameters include (but not limited to):
  - 4. Maximum power in Watts
  - 5. Maximum Designed Junction Temperature
  - 6. L70 in hours, when extrapolated for the average operating temperature
  - 7. Product submittals shall be accompanied by performance data that is derived in accordance with appropriate IESNA testing standards and tested in a laboratory that is NVLAP accredited for Energy Efficient Lighting Products.
  - 8. Product submittals shall be accompanied by a test report showing surge protection performance as tested per the definitions and procedures in ANSI/IEEE C62.41 1991
  - 9. Thermal testing data and reporting shall be provided based in the sensor input as defined below:
    - a. Temperature sensors shall be mounted on the LED solder pads as close to the LED as possible.
  - 10. Burn-In: Before any customer design qualification testing is performed, the sample Luminaires shall be energized for a minimum of 24 hours, at 100 percent on-time duty cycle, at a temperature of +70°F (+21°C).
  - 11. Any failure of the luminaire, which renders the unit non-compliant with the specification after burn-in, shall be cause for rejection.
  - 12. The luminaire shall be tested as described herein.
    - a. Luminaire performance shall be judged against the specified minimum illuminance in the specified pattern for a particular application.
    - b. The luminaire lighting performance shall be adjusted (depreciated) for the minimum life expectancy.

- 1) The performance shall be adjusted (depreciated) by using the LED manufacturer's data or the data from the IESNA Standard LM-80-08 test report, which ever one results in a higher level of lumen depreciation.
- c. The luminaire may be determined to be compliant photometrically, if:
  - 1) The initial minimum illuminance level is achieved in 100% of the area of the specified lighting pattern, and
  - 2) The depreciated minimum illuminance is maintained in at least 95% of the area of the specified lighting pattern, and
  - 3) The minimum length of the depreciated iso-footcandle curve is equal or greater than the length of the specified iso-footcandle curve.

### 3.8 QUALITY ASSURANCE TESTING (RANDOM SAMPLE TESTING)

- A. Random sample testing may be performed on all shipments.
- B. Testing shall be completed within 30 days.
- C. All parameters of the specification may be tested on the shipment sample.

## PART 4 - EXECUTION

### 4.1 INSPECTION AND PREPARATION

#### A. General

1. Install outlets, surface mounted, recessed or semi-recessed fixtures to maintain the alignment, spacings, layout and general arrangements indicated in the Drawings. Obtain approval of Engineer for all changes in layout required to avoid interferences with other trades.
2. Install one light fixture of each type and mounting for approval of Owner and Engineer prior to mounting all light fixtures.

#### B. Coordination

1. Work incorporating with ceiling trades in locating and framing recessed fixtures in acoustical tile pattern or grid system to conform to layout.
2. Inform affected trades of the location and framing details necessary for the installation of flush fixtures and deliver all framing rings of these fixtures that become a part of the ceiling construction.
3. Before equipment is ordered, electrical contractor to review luminaire and ceiling mechanical compatibility in each area and verify luminaire on the drawings. Contractor shall be responsible for all fixture quantities, lengths and clearances required and shall inform the Owner of the job conditions at variance with the fixture(s) specified or detailed which affect installation or location. (All stages of installation.)
4. Mechanical and electrical contractors are to review and coordinate lighting locations in relationship to mechanical systems to minimize conflicts prior to installation.

5. This contractor is responsible for coordinating the characteristics and the U.L. labeling of the luminaires and their components with the ambient conditions, which will exist when the luminaires are installed. No extra compensation will be permitted for failure to coordinate the luminaires with their ambient conditions.

C. Mounting and Supports

1. Install luminaires in mechanical and unfinished areas after ductwork and piping installation.
2. Where luminaires are surface mounted, they shall be labeled for such and a minimum of one-half (1/2) inch air space and shall be maintained between top of luminaire and mounting surface by an approved means.
3. Pendant mounted units shall comply with the following:
  - a. Where luminaires are mounted in a continuous row, luminaires, eight feet in length shall have stems placed within 2'-0" of end of fixture. Stems shall be spaced symmetrically. A fixture, four feet or three feet in length, placed in a row, shall have a stem connected to center luminaire.
  - b. Individual luminaires, four feet in length, shall have two stems placed approximately 3 inches from each end.
  - c. Individual luminaire, three feet in length, shall have dual stems and a single canopy.
  - d. Each stem shall have a brass or steel swivel or other self-aligning device of type approved by the Engineer.
4. Where luminaires are mounted on surface-mounted outlet boxes in surface mounted conduit runs, this Contractor shall furnish and install a luminaire canopy sufficiently deep to permit exposed conduits to pass through. Canopy shall have proper openings cut by luminaire manufacturer through which conduits may pass. Submit sample of canopy for approval before installation.
5. Prior to final payment, this contractor shall clean all luminaires and replace any burned out LED modules. He shall also touch up all scratch marks, etc. in an approved manner.
6. Provide a minimum of two support points for all surface, pendant or recessed mounted luminaires. The supports shall be tied to the building structural system. The support points shall be totally independent of the ceiling system.
7. Recessed luminaires to be installed in metal panel or acoustic modular ceilings shall be modified as required to fit into openings in ceiling construction. Shop Drawings showing details shall be submitted for approval.
8. All luminaires in hung ceilings are to be installed with earthquake clips.

D. Emergency Systems Raceway and Hook-up

1. Circuit wiring for the emergency systems shall be installed in separate raceway and kept entirely independent of all other wiring and equipment.

4.2 ADJUSTING AND CLEANING

A. At project completion, before final approval:



1. Aim adjustable fixtures as directed by Engineer and observe and adjust at night as required.
2. Clean interior of all fixtures, all lenses and LED modules.

END OF SECTION 265200

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## SECTION 271000 - TELEVISION RACEWAY SYSTEM

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. General: Provide raceways, outlet boxes and accessories for the owner furnished television cabling system as directed by the equipment supplier. Coordinate with Owner and Owner's Equipment Vendor to ensure compatibility and quality of all new equipment supplied.

### PART 2 - PRODUCTS

#### 2.1 RACEWAY

- A. Provide 3/4" EMT conduit stubs from the outlets to above accessible ceilings. Provide pull strings in raceway system.
- B. Television outlets shall consist of a 4-11/16" square outlet box, single gang plaster ring and 3/4" conduit turned out above accessible ceiling with nylon grommet on end of conduit.

### PART 3 - EXECUTION

#### 3.1 RACEWAY SYSTEM

- A. Install capped bushings on raceways as soon as installed.

#### 3.2 OUTLET AND PULLBOXES

- A. Provide outlet and pullboxes as indicated on the Drawings and as required for the complete installation of the systems.
- B. Bring any discrepancies found between the Specification and the Drawing immediately to attention of the Engineer. Installation and details indicated on the Drawings shall govern if they differ from the Specifications.
- C. All conduits shall be bonded to the building steel via a ground strap.

END OF SECTION 271000

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## SECTION 271500 - COMMUNICATIONS CABLING

### PART 1 – GENERAL

#### 1.1 GENERAL INFORMATION

- A. The Washington County Maryland Government Information Technology Department provides all of the technology services county-wide including infrastructure, program development, support and maintenance, data systems, and geographic information systems.

#### 1.2 DESCRIPTION OF SPECIFICATIONS

- A. The work covered in this Specification consists of low voltage work including the design, installation, maintenance, and repair of the following equipment:
  - 1. Telephone systems
  - 2. Wireless Access Points
  - 3. LAN and various computer related systems
  - 4. Video Systems
  - 5. Other miscellaneous low voltage cabling
- B. This document defines the cabling system and subsystem components to include cable, termination hardware, supporting hardware, and miscellaneous materials that the Contractor will furnish to install a complete telecommunications system supporting voice and data. The intent of this contract is to provide all pertinent information to allow the Contractor to bid the labor, materials supervision, tooling, and miscellaneous mounting hardware and consumables to install a complete system. However, it is the responsibility of the Contractor to propose any, and all items required for a complete system if not identified in the Bill of Materials attached to this specification. These specification supersede any other specifications.

#### 1.3 TELECOMMUNICATIONS SYSTEMS DESCRIPTION

- A. Installer deploys four data circuits to each user outlet as a standard configuration. The data circuits are provided via four Category 6 cables to each outlet. Horizontal data cables are terminated on rack-mounted Category 6 patch panels, Horizontal data circuits are connected to LAN electronics within each TC.
- B. A twenty-four strand OM3 50/125-micron multimode fiber optic backbone is employed between the data MC and each TC for data connectivity within the data MC and the TCs, backbone fiber strands are terminated and housed in rack-mount fiber optic enclosures.
- C. Wireless (wi-fi) installations will require two Category 6A cabling system to each Wireless Access Point to comply with 802.11ac and future standards.

#### 1.4 STANDARDS AND WARRANTIES

- A. Reference Standards
  - ANSI/TIA-492.AAAC-B – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-index Multimode Optical Fibers (OM3/OM4). Current Edition
  - ANSI TIA-492-A Data Center Cabling
  - ANSI TIA-492.CAAB – Detail Specification for Class Iva Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak. Current Edition
  - ANSI/TIA 526 – OFSTP-19 Optical Signal-to-Noise Ratio Measurement Procedures for Dense Wavelength-Division Multiplexed Systems.
  - ANSI/TIA-568-0-D – Generic Communications Cabling for Customer Premises.
  - ANSI/TIA-568-1-D – Commercial Building Communications Cabling Standard Part 1: General Requirements.
  - ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
  - ANSI/TIA 568-C.3 – Optical Fiber Cabling Components Standard
  - ANSI/TIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces.
  - ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure.
  - ANSI/JSTD-607-C – Commercial Building Bonding and Grounding (Earthing) Requirements for Telecommunications.
  - NFPA 70 – National Electrical Code (NEC).
  - BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM)

## 1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's product data sheets, including installation instructions verifying that materials comply with specified requirements and are suitable for intended application.
- B. Installer's Project References: Submit installer's list of successfully completed communications horizontal cabling projects, including project name and location, name of architect, and type and quantity of communications horizontal cabling installed.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged, for past 10 years, in manufacture of communications horizontal cabling of similar type to that specified.
- B. Installer's Qualifications:
  - 1. Contractor must be an approved Leviton Authorized Network Installer or Berk-Tek Oasis Integrator before, during, and through completion of the system installation. Supporting certification documentation will be required as part of the submittal.

2. The Contract will, in general, be awarded to the lowest qualified bidder. The Washington County Government reserves the right to accept or reject any or all bids in part or whole, whether from responsible bidders or otherwise, even though the bidder may not submit the lowest bid. Washington County Government has sole discretion in determining the best interest of the county and to waive any informality deemed to be in the best interest of Washington County Government.
3. The Contractor will supply as built drawings/designs, all wiring, cabling and other equipment to meet the needs of any installation. The Contractor must maintain a minimum stock of parts and equipment to deal with any repair requests within 24 hours or one workday.
4. The Contractor is responsible for workmanship and installation practices in accordance with Leviton Installer Program and the Berk-Tek Oasis Program.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
  1. Store and handle materials in accordance with manufacturer's instructions.
  2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
  3. Store materials in clean, dry area indoors.
  4. Protect materials during storage, handling, and installation to prevent damage.

#### 1.8 WARRANTY

**The horizontal communications cabling system installed shall be eligible for coverage by a Limited Lifetime Warranty to the end user.**

- A. Horizontal channels shall be completed with Leviton Network Solutions factory-terminated copper and/or fiber optic patch cords in order to be eligible for the applicable Berk-Tek or Leviton Warranty with channel performance guarantees.
- B. Approved product shall be listed on the most recent version of the applicable Berk-Tek Leviton Technologies data sheets for each Berk-Tek Leviton Technologies solution.
- C. Installer/ Integrator shall provide labor, materials, and documentation in accordance with Berk-Tek Leviton Network Technologies requirements necessary to ensure that the Owner will be furnished with a Limited Lifetime Warranty.
- D. The installed structured cabling system shall provide a warranty guaranteeing installed channel performance above the ANSI/TIA 568-C requirements for Cat 6, and/or Cat 6A cabling systems or ISO 11801 requirements for Class D, Class E, and/or Class E<sub>a</sub>.

1. Standards-compliant channel or permanent link performance tests shall be performed in the field with a Berk-Tek Leviton Technologies approved certification tester in the appropriate channel or permanent link test configuration. See 1.8 A.1 above for channel requirements.
2. Necessary documentation for warranty registration shall be provided to the manufacturer by the installer (within 10 days) following 100 percent testing of cables.
3. Submit test results to Leviton Network Solutions or to Berk-Tek, in the certification tester's original software files.
4. Installer shall ensure that the warranty registration is properly submitted, with all required documentation within 10 days of project completion.
5. Contractor/Integrator must adhere to the terms and conditions of the respective manufacturer's warranty programs.
6. Installer shall ensure that the Washington County Government receives the Berk-Tek Leviton Technologies manufacturer issued project warranty certificate within 90 calendar days of warranty registration.

## PART 2 - PRODUCTS

### PRODUCT REQUIREMENTS

#### 2.1 MANUFACTURERS

- A. Leviton Network Solutions, 2222 222<sup>nd</sup> Street SE, Bothell, Washington 98021. Phone 425-486-2222. Website: [www.leviton.com](http://www.leviton.com).
- B. Berk-Tek, A Nexans Company, 132 White Oak Road, New Holland, PA 17557 Phone: 717-354-6200. Website: [www.berktek.com](http://www.berktek.com).
- C. Great Lakes Case & Cabinet, 4193 Route 6N, Edinboro, PA 16412 Phone: 866-879-4522
- D. Website: [www.greatcabinets.com](http://www.greatcabinets.com)
- E. STI Specified Technologies Inc, 210 Evans Way, Somerville, NJ 08876 Phone: 800-992-1180
- F. Website: [www.stifirestop.com](http://www.stifirestop.com)
- G. WBT 115 Harting Drive, Centralia, IL 62801, 618-918-3824 Website: [www.wbtray.com](http://www.wbtray.com)

#### 2.2 SYSTEM DESCRIPTION

- A. Horizontal Distribution Subsystem: Intra-building twisted-pair and fiber optic communications cabling connecting Telecommunication Rooms (TRs) to Telecommunication Outlets (TOs) located at individual work areas.
- B. Horizontal Copper Cabling: Combination of the following types of cables from TR to TO:



1. Category 6A (WAP locations) or Category 6 WO, (100-Ohm, 4-pair, unshielded twisted pair) cables from TRs to TOs, or Category 6A or Category 6 (100-Ohm, 4-pair, shielded twisted pair) cables from TRs to TOs.
- C. Horizontal and Backbone Fiber Cabling: 50/125  $\mu$ m, OM3, 850 nm Bend-insensitive Laser Optimized
- D. Communications Horizontal Cabling System: Includes cables, jacks, patch panels, connecting blocks, patch cords, fiber connectors, fiber adapter plates, fiber enclosures, jumpers, and necessary support systems, such as cable managers and faceplates.
- E. Cables: Route through conduit, cable trays, spaces below raised floors, open ceiling areas, non-ventilated spaces above ceiling tile, and through plenum air-handling spaces above ceiling tile.
- F. Furnish and install all materials necessary for a complete and working communications horizontal cabling system.

## 2.3 CABLING SYSTEMS MATERIAL SPECIFICATIONS

- A. WIRELESS ACCESS POINT CABLING-Category 6A Unshielded Twisted Pair Category 6A UTP System
  1. 100 ohm, Category 6A, 23 AWG, 4-pair unshielded twisted pair with innovative crosstalk prevention (XTP) technology. LANmark-XTP, CMP rated.
  2. Jacket Color: White.
  3. Electrical Characteristics: Characterized to 750 MHz.
  4. Cable: Third-party verified by ETL.
  5. Maximum Cable Diameter: 0.275 inch.
  6. Berk-Tek LANmark-XTP Category 6A CMP
    - a. All category cabling manufacturers must be able to provide documentation from an independent third-party testing agency that verifies through random sampling that cable components perform at or above the levels contained on their product specifications, not simply at or above the standard.
  7. Channel margin guarantees for a **Category 6A UTP System** (margin vs. ANSI/TIA-568-C.2 and margin guarantees are for a 4-connector channel).

Insertion Loss	3 %
NEXT	5 dB
PSNEXT	6 dB
ACR-F (ELFEXT)	10 dB
PSACR-F (PSELFEXT)	10 dB
Return Loss	4 dB
ACR-N	7 dB
PSACR-N	7 dB
PSANEXT	5 dB
PSAACR-F	11 Db
- B. Specified Vendor Product Selection:

1. Berk-Tek Category 6A, 23 AWG, 4-pair unshielded twisted pair with innovative crosstalk prevention (XTP) technology.  
Berk-Tek LANmark-XTP, White jacket CMP Plenum rated  
**Berk-Tek Part Number 11082058**
2. Category 6A Modular Jacks: **Category 6A UTP System**  
8-position eXtreme QuickPort modular jack, Category 6A, IDC terminals, T568A/B wiring scheme.  
Channel-rated jack.  
Each Jack: Identified on its face as CAT 6A.  
Jack Color: WHITE.  
**Leviton Part Number 6110G-RW6 (White).**

C. WORKSTATION CABLING -Category 6 Unshielded Twisted Pair: Category 6 UTP System

1. 100 ohm, Category 6, 23 AWG, 4-pair unshielded twisted pair, Berk-Tek LANmark 1000, CMP rated.
2. Jacket Color: Blue.
3. O.D. 0.230"
4. Electrical Characteristics: Characterized to 550 MHz.
5. Each Pair in Cable: Insulated with FEP.
6. Cable: Third-party verified by ETL.
7. Berk-Tek LANmark-1000 CMP  
All category cabling manufacturers must be able to provide documentation from an independent third-party testing agency that verifies through random sampling that cable components perform at or above the levels contained on their product specifications, not simply at or above the standard.  
Channel margin guarantees for a **Category 6 UTP System** (margin vs. ANSI/TIA-568-C.2 and margin guarantees are for a 4-connector channel).

Insertion Loss	5 %
NEXT	6 dB
PSNEXT	6 dB
ACR-F (ELFEXT)	8 dB
PSACR-F (PSELFEXT)	9 dB
Return Loss	3 dB
ACR-N	7 dB
PSACR-N	8 dB
8. Specified Vendor Product Selection:  
Category 6, 23AWG, 4-pair unshielded twisted pair cable  
Berk-Tek LANmark 1000, Jacket Color BLUE CMP Rated  
**Part Number 11074694 (1500' SmartPak box)**  
**Part Number 10032094 (1000' TekPak box)**  
Category 6 Modular Jacks: Cat 6 UTP System  
8-position Leviton eXtreme QuickPort modular jack, Category 6, IDC terminals, T568A/B wiring scheme, component-rated jack. Each Jack: Identified on its face as CAT 6. Color: Blue  
**Part Number: Leviton 61110-RL6 (blue)**

D. VIDEO CAMERA CABLING -Category 6 Unshielded Twisted Pair: Category 6 UTP System

1. 100 ohm, Category 6, 23 AWG, 4-pair unshielded twisted pair, Berk-Tek LANmark 1000, CMP rated.

2. Jacket Color: Green
3. O.D. 0.230"
4. Electrical Characteristics: Characterized to 550 MHz.
5. Each Pair in Cable: Insulated with FEP.
6. Cable: Third-party verified by ETL.
7. Berk-Tek LANmark-1000 CMP

All category cabling manufacturers must be able to provide documentation from an independent third-party testing agency that verifies through random sampling that cable components perform at or above the levels contained on their product specifications, not simply at or above the standard.

Channel margin guarantees for a **Category 6 UTP System** (margin vs. ANSI/TIA-568-C.2 and margin guarantees are for a 4-connector channel).

Insertion Loss	5 %
NEXT	6 dB
PSNEXT	6 dB
ACR-F (ELFEXT)	8 dB
PSACR-F (PSELFEXT)	9 dB
Return Loss	3 dB
ACR-N	7 dB
PSACR-N	8 dB

8. Specified Vendor Product Selection:  
Category 6, 23AWG, 4-pair unshielded twisted pair cable  
Berk-Tek LANmark 1000, Jacket Color GREEN CMP Rated  
**Part Number 11074895 (1500' SmartPak box)**  
**Part Number 10032097 (1000' TekPak box)**  
Category 6 Modular Jacks: Cat 6 UTP System  
8-position Leviton eXtreme QuickPort modular jack, Category 6, IDC terminals, T568A/B wiring scheme, component-rated jack. Each Jack: Identified on its face as CAT 6. Color: Green  
**Part Number: Leviton 61110-RV6 (Green)**

E. TELEVISION CABLING -Category 6 Unshielded Twisted Pair: Category 6 UTP System

1. 100 ohm, Category 6, 23 AWG, 4-pair unshielded twisted pair, Berk-Tek LANmark 1000, CMP rated.
2. Jacket Color: Black
3. O.D. 0.230"
4. Electrical Characteristics: Characterized to 550 MHz.
5. Each Pair in Cable: Insulated with FEP.
6. Cable: Third-party verified by ETL.
7. Berk-Tek LANmark-1000 CMP

All category cabling manufacturers must be able to provide documentation from an independent third-party testing agency that verifies through random sampling that cable components perform at or above the levels contained on their product specifications, not simply at or above the standard.

Channel margin guarantees for a **Category 6 UTP System** (margin vs. ANSI/TIA-568-C.2 and margin guarantees are for a 4-connector channel).

Insertion Loss	5 %
NEXT	6 dB
PSNEXT	6 dB

ACR-F (ELFEXT)	8 dB
PSACR-F (PSELFEXT)	9 dB
Return Loss	3 dB
ACR-N	7 dB
PSACR-N	8 dB

8. Specified Vendor Product Selection:  
Category 6, 23AWG, 4-pair unshielded twisted pair cable  
Berk-Tek LANmark 1000, Jacket Color BLACK CMP Rated  
**Part Number 11074899 (1500' SmartPak box)**  
**Part Number 10032208 (1000' TekPak box)**  
Category 6 Modular Jacks: Cat 6 UTP System  
8-position Leviton eXtreme QuickPort modular jack, Category 6, IDC terminals, T568A/B wiring scheme, component-rated jack. Each Jack: Identified on its face as CAT 6. Color: BLACK  
**Part Number: Leviton 61110-RE6 (black)**  
For the TV's a LYNX Broadband Adapter shall be used (Cat 6 on the backside and coax on the front)

F. MODULAR JACKS AND FIBER ADAPTERS FOR WORKSTATION OUTLETS

Category 6A and Category 6 Modular Jacks:

1. 8-position modular jack, Category 6A and Category 6, IDC terminals, T568A/B wiring scheme.
2. The modular connector shall exceed all component performance requirements in the ANSI/TIA-568-C.2 standard for Augmented Category 6 from 1 MHz to 500 MHz to support the IEEE 802.3an standard for 10GBASE-T network performance
3. The Modular Connector shall be terminated without the need for any punch down tool or other specialized or proprietary termination tool.
4. The Connector Module shall feature a termination wire manager that holds individual conductors in place during termination.
5. The Modular Connector termination method shall be consistent with the termination method available for UTP modules from the same manufacturer. The same termination method shall also be consistent with 6 and 6A shielded modules from the same manufacturer.
6. The Modular Connector shall be reusable and support multiple termination and re-termination cycles and be facilitated by simple termination release levers.
7. The modular connector shall be independently tested and verified by Intertek (ETL) to exceed Category 6A and Category 6 component performance.
8. The eight-position connector module shall utilize a method of line tensioning that prevents six-position modular plug insertion from damaging either the cord or the module.
9. The connector body shall be made of die-cast zinc and all plastic components shall be made of high-impact, fire-retardant plastic rated UL 94V-0.
10. The connector shall also be in compliance with all National Electrical Codes; compliant with ANSI/TIA-1096-A (formerly FCC Part 68); cULus Listed; and independently tested for component compliance.
11. In addition to Category 6A and Category 6 component compliance, the connector shall have the ability to support high megabit and shared sheath applications.
12. Connector wiring shall be universal and will accommodate both T568A and T568B pair/pin assignments.

13. The connector shall incorporate a triple-stage compensation design with integrated flexible circuit design that enhances link and channel performance.
14. The modular connector shall fit a range of telecommunications faceplates, outlets, and field-configurable patch panels.
15. The modular connector shall be available in 13 TIA 606-A compatible colors.
16. Connector Modules shall be available with an internal shutter option to protect against dust and debris
17. Connector Module shall have a maximum depth of 1.31”
18. Each connector shall be identified on its face as CAT 6A or CAT 6.
19. Basis for design: Leviton eXtreme UTP Category 6A and Category 6 Connector.
20. All jack colors are to match cable colors:

Wireless Access Points:	White
Data:	Blue
Camera:	Green
Television:	Black

## 2.4 WORK AREA OUTLETS

### A. Flush-Mounted Stainless Steel ANGLED Faceplates:

1. Use 4-port flush ANGLED QuickPort faceplates. Faceplates shall be constructed of 304 Grade Stainless Steel in a brushed finish to provide corrosion resistance in a non-magnetic material and fit NEMA electrical boxes. Each faceplate shall contain four Category 6 jacks for data. There shall be four Category 6 cables terminated as noted in 3.1 above. Each port shall be provided with an icon to indicate its function. Faceplates shall accommodate two labels and provide a clear polycarbonate cover for each. Faceplates shall be LEVITON part number 43081-2L4 or an approved equivalent. The faceplates shall be mounted to in-wall single gang boxes  
Specified Vendor Product Selection  
4-port dual-gang Stainless Steel ANGLED wallplate with ID windows.  
Stainless Steel Plates  
**Part Number: Leviton 43081-2L4**

## 2.5 WIRELESS ACCESS POINT OUTLETS

- ### A. In-Ceiling Brackets - Mounting QuickPort Jacks, Connectors, 1 & 2 Port Surface Mounted Box, with 10 foot Slack Loops.
- Specified Vendor Product Selection  
QuickPort In-Ceiling 2 Port Bracket, includes clip for drop wire/rod  
Colors: Metal  
Part Number: Leviton 49223-CBC.  
QuickPort In-Ceiling 2 Port Bracket, no clip.  
Colors: Metal  
**Part Number: Leviton 49923-CB0.**

## 2.6 COPPER RACKMOUNT PATCH PANELS

- ### A. Modular Patch Panels: **Category 6A UTP System and Category 6 UTP System**

Specified Vendor Product Selection – QuickPort Patch Panel with Magnifying Lens Label Holder. Cable Management bar included. Suitable to accept all colors of QuickPort modular jacks and adapters. These panels are unloaded. The panel fits all industry-standard 19-inch racks and cabinets. The installer must obtain QuickPort modular jacks to insert based on solution color.

All jack colors are to match cable colors:

Wireless Access Points: White

Data: Blue

Camera: Green

Television: Black

Specified Vendor Product Selection

**24-port, flat panel, Part Number: Leviton 49255-L24.**

**48-port, flat panel, Part Number: Leviton 49255-L48**

## 2.7 OPTICAL FIBER CABLE, OM3 FIBER OPTIC SYSTEM:

### A. Each Multimode Fiber shall be:

1. Graded-index optical fiber wave-guide with nominal OM4 50/125µm-core/cladding diameter.
2. The fiber shall comply with the latest revision of ANSI/EIA/TIA-492AAAC.
3. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-78.
4. Information transmission capacity shall be measured in accordance with the latest revision of ANSI/EIA/TIA-455-204.
5. The measurements shall be performed at  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .
6. Maximum attenuation dB/km @ 850/1300 nm: 3.0/1.0
7. EMB Bandwidth 2000 MHz-km @ 850nm.
8. OFL Bandwidth 500 MHz-km @ 1300nm.
9. Optical Fiber shall be Bend-insensitive Laser Optimized and guarantee 1Gigabit Ethernet distances of 1000m/600m for 850nm and 1300nm, respectively.
10. Optical fiber shall guarantee a 10 Gigabit Ethernet distance of 300m at 850nm

### B. Physical Characteristics:

1. Shall be suitable for use in indoors or in indoor/outdoor applications.
2. Appropriately flame rated optical cable shall be suitable for use in risers, plenums and horizontal applications.
3. Plenum rated optical cables shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating. Riser rated optical cables shall have and be marked with an UL-OFNR and OFN FT4 Flame Rating
4. Shall comply with the requirements of ICEA S-83-596 (Premises), ICEA S-104-696 (I/O), or ANSI/ICEA S-87-640 (Outside Plant, OSP).
5. Suitable for underground or aboveground conduits.
6. Optical cables and fibers shall be color coded in accordance with EIA/TIA-598-C.
7. Shall have a ripcord for overall jacket.

### C. Specified Vendor Product Selection:

1. Berk-Tek INDOOR/OUTDOOR Plenum ARMORED optical fiber cable with OM3 Bend-insensitive Laser Optimized 50/125 micron fiber (24 Bend-insensitive Laser Optimized optical fibers, Indoor/Outdoor Tight Buffer)  
**Berk-Tek Part Number: PDPK024EB3010/25-I/O-C4C5(AQU)**

## 2.8 FIBER OPTIC TERMINATION ENCLOSURES and SPLICE TRAYS.

- A. Opt-X 1000i SDX Fiber Optic Enclosures: all metal enclosure, rack mountable, holds various fiber adapter plates, splice trays, or MTP modules, based on connector choice and density requirements.
  1. 1RU Opt-X 1000i rack-mount Fiber Optic Enclosure, empty, with sliding tray.
  2. Capacity: 72 fiber strands (LC), 3 fiber adapter plates and 3 splice trays, or 3 MTP modules  
Part Number: Leviton 5R1UM-S03.
  3. 2RU Opt-X 1000i rack-mount Fiber Optic Enclosure, empty, with sliding tray.
  4. Capacity: 144 fiber strands (LC), 6 fiber adapter plates and 6 splice trays, or 6 MTP modules  
Part Number: Leviton 5R2UM-S06.
  5. 3RU Opt-X 1000i rack-mount Fiber Optic Enclosure, empty.
  6. Capacity: 216 fiber strands (LC), 9 fiber adapter plates and 9 splice trays, or 9 MTP modules  
Part Number: Leviton 5R3UM-F09.
  7. 4RU Opt-X 1000i rack-mount Fiber Optic Enclosure, empty.
  8. Capacity: 288 fiber strands (LC), 12 fiber adapter plates and 12 splice trays, or 12 MTP modules  
Part Number: Leviton 5R4UM-F12.
- B. Opt-X 1000 Fiber Optic Wall-mount Enclosures: All metal enclosure, holds various fiber adapter plates, splice trays, or MTP modules, based on connector choice and density requirements. Part numbers shown have a split metal door with key lock.
  1. Small Opt-X 1000 wall-mount Fiber Optic Enclosure, empty.
  2. Capacity: 48 fiber strands (LC), 2 fiber adapter plates
  3. Part Number: Leviton 5W120-00N.
  4. Medium Opt-X 1000 wall-mount Fiber Optic Enclosure, empty.
  5. Capacity: 96 fiber strands (LC), 4 fiber adapter plates and 6 splice trays
  6. Part Number: Leviton 5W320-00N.
  7. Large Opt-X 1000 wall-mount Fiber Optic Enclosure, empty.
  8. Capacity: 288 fiber strands (LC), 12 fiber adapter plates and 6 splice trays
  9. Part Number: Leviton 5W720-00N.

## 2.9 FIBER OPTIC ADAPTER PLATES

- A. 50µm Laser-optimized Multimode (LOMM) SDX Adapter Plates, for **OM3 50/125µm Fiber Optic System**
  1. 6-LC duplex (12-fiber) multimode OM3/OM4, aqua adapter plate, zirconia-ceramic sleeves. Part Number: Leviton 5F100-2QL.
  2. 6-SC duplex (12-fiber) multimode OM3/OM4, aqua adapter plate, zirconia-ceramic sleeves. Part Number: Leviton 5F100-2QC

2.10 FIBER OPTIC CONNECTORS

- A. OM3 and OM4 Laser-optimized Multimode (LOMM) Field Installable Fiber Optic Connectors (aqua): Use for OM3 50/125um Fiber Optic System
  - 1. FastCam LC Connector Part Number: Leviton 49991-LLC
  - 2. FastCam SC Connector Part Number: Leviton 49991-LSC

2.11 PATCH CORDS/JUMPERS

- A. Atlas-X1 Category 6A Modular Patch Cords:
  - 1. Cat 6A UTP System Slim-Line style, Category 6A, shielded cord 4-pair, stranded wire construction.
- B. Part Numbers: WIRELESS ACCESS POINT PATCH CORD ASSEMBLIES
  - 1. **Leviton 6AS10-03W (3 feet, White)**
  - 2. **Leviton 6AS10-05W (5 feet, White)**
  - 3. **Leviton 6AS10-07W (7 feet, White)**
  - 4. **Leviton 6AS10-10W (10 feet, White)**
  - 5. **Leviton 6AS10-15W (15 feet, White)**
  - 6. **Leviton 6AS10-20W (20 feet, White)**
- C. Atlas-X1 Category 6 Modular Patch Cords:
  - 1. Cat 6 UTP System Slim-Line style, Category 6 UTP patch cord, 4-pair, stranded wire construction.
- D. Part Numbers: DATA PORT PATCH CORD ASSEMBLIES
  - 1. **Leviton 6D560-03L (3 feet, Blue)**
  - 2. **Leviton 6D560-05L (5 feet, Blue)**
  - 3. **Leviton 6D560-07L (7 feet, Blue)**
  - 4. **Leviton 6D560-10L (10 feet, Blue)**
  - 5. **Leviton 6D560-15L (15 feet, Blue)**
  - 6. **Leviton 6D560-20L (20 feet, Blue)**
- E. Part Numbers: CAMERA PATCH CORD ASSEMBLIES
  - 1. **Leviton 6D560-03G (3 feet, Green)**
  - 2. **Leviton 6D560-05G (5 feet, Green)**
  - 3. **Leviton 6D560-07G (7 feet, Green)**
  - 4. **Leviton 6D560-10G (10 feet, Green)**
  - 5. **Leviton 6D560-15G (15 feet, Green)**
  - 6. **Leviton 6D560-20G (20 feet, Green)**
- F. Part Numbers: TELEVISION PORT PATCH CORD ASSEMBLIES
  - 1. **Leviton 6D560-03E (3 feet, Black)**



2. **Leviton 6D560-05E (5 feet, Black)**
3. **Leviton 6D560-07E (7 feet, Black)**
4. **Leviton 6D560-10E (10 feet, Black)**
5. **Leviton 6D560-15E (15 feet, Black)**
6. **Leviton 6D560-20E (20 feet, Black)**

G. OM3 Fiber Optic System: Factory-terminated, double-ended, 2-strand multimode cordage, color (aqua).

1. Duplex LC-Duplex LC:
  - a. **Leviton 5LDLC-M01 (1 meter)**
  - b. **Leviton 5LDLC-M02 (2 meter)**
  - c. **Leviton 5LDLC-M03 (3 meter)**
  - d. **Leviton 5LDLC-M05 (5 meter)**
  - e. **Leviton 5LDLC-M10 (10 meter)**
2. Duplex SC-Duplex SC:
  - a. **Leviton 5LDSC-M01 (1 meter)**
  - b. **Leviton 5LDSC-M02 (2 meter)**
  - c. **Leviton 5LDSC-M03 (3 meter)**
  - d. **Leviton 5LDSC-M05 (5 meter)**
  - e. **Leviton 5LDSC-M10 (10 meter)**

## 2.12 DISTRIBUTION RACKS AND WIRE MANAGEMENT

### A. Distribution Racks

Distribution racks shall be from **Great Lakes Case & Cabinet:**

- 2 Post Distribution Rack  
Two Post Rack with mounting hardware:  
84" x 20.31W X 14"D, 45 RMU  
1500lb capacity  
Black anodized finish

Specified Vendor Product Selection

**Great Lakes Case & Cabinet P/N GLRR-1984BA**

- 4 Post Distribution Rack  
Four Post Rack with Variable Depth with mounting hardware:  
84"H, Variable depth 4 Post Rack, 45 RMU  
Side rail offers variable depth from 24-36"  
Black anodized finish

Specified Vendor Product Selection

**Great Lakes Case & Cabinet P/N VD4P1224-2436**

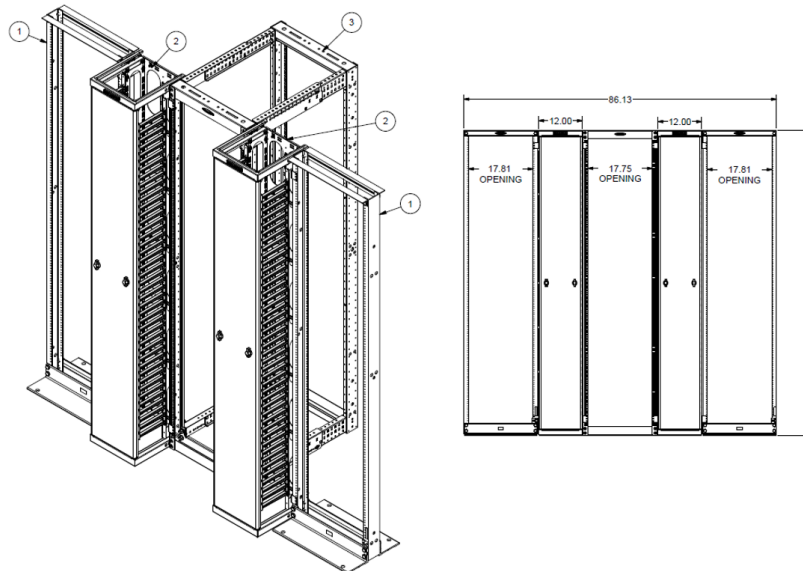
### B. Wire Management

- Metal Vertical Cable Management  
12" Channel x 80"Length  
Vertical Front Only Manager, includes dual hinged cover

Specified Vendor Product Selection

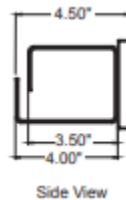
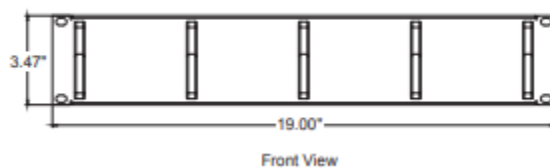
**Great Lakes Case & Cabinet P/N VCM12**

**BASIS OF RACK LAYOUT Figure 3.0**



- Horizontal Cable Management for rack mount systems  
2U Horizontal Wire Manager with Snap On Cover  
Front Only Manager, includes cover  
Specified Vendor Product Selection  
**Leviton P/N 49253-BCM**

**49253-BCM**



## 2.13 FIRESTOP SYSTEMS – COMMUNICATIONS CABLING

- A firestop system is comprised of: the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.
- All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.
- Product Specifications

1. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed fire stopped system, stamped/embossed by the cognizant PE shall be provided to the County's Technical Representative prior to installing the firestop system(s).

D. Firestop System Installation

1. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

2.14 FIRESTOP PERFORMANCE REQUIREMENTS

- A. Fire rated cable pathway devices shall be used in fire-rated construction for ALL low-voltage, video, data and voice cabling, optical fiber raceways and certain high-voltage cabling where frequent cable moves, adds and changes may occur. Pathways required for high voltage cabling will be detailed on the prints. Such devices shall:

1. Meet the hourly fire-rating of fire rated wall and or floor penetrated.
2. Be tested for the surrounding construction and cable types involved.
  - a) Have UL Systems permitting cable loads from; *"Zero to 100% Visual Fill."* This requirement eliminates need for fill-ratio calculations to be made by cable technicians to ensure cable load is within maximum allowed by UL System.
  - b) Not have inner fabric liner that tightens around and compresses cables tightly together encouraging potential cable damage or interference.
  - c) Be *"Zero-Maintenance"*, zero-maintenance is defined as; No action required by cabling technician to open and/or close pathway for cable moves, adds or changes, such as, but not limited to:
    - 1) Opening or closing of doors.
    - 2) Spinning rings to open or close fabric liner.
    - 3) Removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
    - 4) Evaluation Services Report (ESR) from an accredited Nationally Recognized Third-party Laboratory certifying compliance with this definition of *"Zero-Maintenance"* and all relevant codes and standards.
  - d) Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
  - e) Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
  - f) Cable Pathway Devices passing vertically through floors shall have equal F & T Rating. (See UL System # F-A-3037, Item #4 *"EZ-PATH Grid T-Rating Kit"* Part # TRK444)
  - g) Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

- B. Non rated cable pathway devices shall be used in non-fire-rated construction for ALL low-voltage, video, data and voice cabling, optical fiber raceways and certain high-voltage cabling where frequent cable moves, adds and changes may occur. Pathways required for high voltage cabling will be detailed on the prints. Such devices shall:
- C. Limit the movement of smoke and sound of wall and or floor penetrated.
- D. Restore the STC Rating of the penetrated assembly.
- E. Provide L Ratings of <1 CFM when empty and <2.5 CFM at all other loading up to 100 percent.
- F. Accommodate cable loads from; *“Zero to 100% Visual Fill.”*
- G. Not have inner fabric liner that tightens around and compresses cables tightly together encouraging potential cable damage or interference.
- H. Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
- I. Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
- J. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.
- K. Be *“Zero-Maintenance”*, zero-maintenance is defined as; No action required by cabling technician to open and/or close pathway for cable moves, adds or changes, such as, but not limited to:
  - L. Opening or closing of doors.
  - M. Spinning rings to open or close fabric liner.
  - N. Removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
  - O. Furnish letter from manufacturer certifying compliance with this definition of *“Zero-Maintenance”*.
- P. As an alternate to using a fire-rated or non-rated cable pathway device for single low voltage cables (up to 0.27 in. (7 mm) O.D) penetrating one or two-hour, gypsum board/stud wall assemblies or non-rated assemblies, either as a through-penetration or as a membrane-penetration, a fire-rated cable grommet may be substituted. The product shall consist of a molded, two-piece, plenum-rated grommet having a foam fire and smoke sealing membrane that conforms to the outside diameter of the individual cable. The grommet product shall be capable of locking into place to secure the cable penetration within the wall assembly. The grommet shall be UL Classified and tested to the requirements of ASTM E814 (UL1479) and CAN/ULC S115.

- Q. Where non-mechanical pathways must be utilized, such as sealing (caulking) around single or grouped conduits, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction. Provide letter from manufacturer certifying compliance with this section.
- R. Cable pathway shall replace conduit sleeves in walls and floors, and;
  - 1. When installed individually in floors, devices shall pass through core-drilled opening utilizing tested floor plates.
  - 2. When multiple units are ganged in floors, devices shall be anchored by means of a tested grid.
  - 3. When installed individually in walls, devices shall pass through core drilled opening utilizing tested wall plates or integrated flanges.
  - 4. When multiple units are ganged in walls, devices shall be anchored by means of a tested grid.
- S. Cable tray shall terminate at each barrier and resume on the other side such that cables pass independently through devices. Cable tray shall be properly supported on each side of the barrier.

## 2.15 FIRESTOP MANUFACTURERS

- A. Acceptable Manufacturer: Specified Technologies Inc., 210 Evans Way, Somerville, NJ 08876. Tel: (800) 992-1180, Fax: (908) 526-9623, Email: techserv@stifirestop.com, Website: www.stifirestop.com.
- B. Substitutions: Not permitted. No known equal.
- C. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer

## 2.16 FIRESTOP MATERIALS

- A. General: Use only products that have been tested for specific fire resistance rated construction conditions or acoustical and smoke related requirements conforming to construction assembly type, penetrating item type, annular space requirements, and rating involved for each separate instance.
- B. Fire-Rated Cable Pathways: STI EZ-PATH® Fire-Rated Pathway device modules comprised of steel pathway with self-adjusting intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
- C. Specified Vendor Product Selection
  - 1. Specified Technologies Inc. (STI) EZ-PATH® Fire Rated Pathway

- D. Smoke and Acoustical Pathways: STI EZ-PATH® Smoke & Acoustical Pathway device module comprised of a nonmetallic pathway with integral self-adjusting smoke and sound sealing system for cable penetrations through non-fire-resistance rated wall or floor assemblies, the following products are acceptable:
- E. Specified Vendor Product Selection
  - 1. Specified Technologies Inc. (STI) EZ-PATH® Smoke & Acoustical Pathway; Model No. NEZ33 or NEZ33CK

2.17 HORIZONTAL CABLE TRAY – COMMUNICATIONS CABLING PATHWAYS  
**CABLE TRAY**

- A. Cable Tray Materials shall consist of tray sections, tray fittings, connectors, supports and all accessories as required for a complete and permanent Cable tray infrastructure. Provide all incidental and/or miscellaneous hardware not explicitly specified or shown on the contract documents that is required for a fully operational and warranted system.
- B. Cable tray components shall be manufactured by a single manufacturer. Components shall not be intermixed between different manufacturers.
  - 1. The cable tray manufacturer shall be:
    - a. WBT Shaped Wire series, or approved equivalent Substitution is not acceptable unless the cable tray manufacturer has been pre-approved prior to bidding. Contractors, in order to obtain approval for cable tray manufacturer substitution, shall submit their request for substitution to the Engineer at least two weeks prior to the bid date. Approval or denial of a substitution request will be based on upon the sole judgment of the Engineer.
- C. Product Specifications:
  - 1. Carbon steel wire, ASTM A653, Continuous galvanization before fabrication. Additional finishing not required.
- D. Cable Tray Finishes:
  - Finish for Carbon Steel Wire after welding;
  - Orange powder-coated surface treatment,
- E. Cable tray will consist of continuous, rigid, welded steel wire mesh cable management system, to allow continuous ventilation of cables and maximum dissipation of heat, with UL Classified splices where tray acts as Equipment Grounding Conductor (EGC). Wire mesh cable tray will have continuous T-welded top wire to protect cable insulation and installers. All cross wires to be WBT's **SHAPED** wire for maximum support.
- F. Provide splices, supports, and other fittings necessary for a complete, continuously grounded system.
  - 1. Mesh: 2 x 4 inches.
  - 2. Straight Section Lengths: 118 inches.

3. Wire Diameter: 5mm minimum construction as specified by manufacturer drawings.
4. Continuous T-Weld top wire to protect cable insulation and installers' hands.
5. Fittings: PreForm UL Classified fittings for pathway transitions (90's, Tee's and Intersections), or utilize standard field-fabricated tray fittings from straight tray sections, in accordance with manufacturer's instructions and Item 2.3.

G. Cable Tray Size:

1. Depth: Cable tray depth will be 6 inches
2. Width: Cable tray width will be 20 inches
3. Length: Cable tray section length will be 118 inches
4. Fill Ratio: Cable tray may be filled to 60% of total fill capacity. Size cable tray to accommodate future cabling changes or additions.

H. Specified Vendor Product Selection

1. **WBT Part Number: WBT6x20 S ORG**
2. Load Span Criteria:
  - a. Install and support cable management system in accordance with the following: [NEMA VE-1 (2002), with Safety Factor of 1.5]
  - b. Cable tray will be capable of carrying a uniformly distributed load of pounds per foot on a support span, according to load tests of standard shown in above.

2.18 CABLE TRAY SUPPORTS & ACCESSORIES

A. Fittings/Support:

1. Wire mesh cable tray fittings are to utilize WBT Pre Form parts or field-fabricated from straight tray sections, in accordance with manufacturer's instructions
2. Ceiling-mounted supports mount to ceiling structure directly or with 1/4", 3/8" or 1/2" threaded rod.
3. Wall-mounted supports.
4. Underfloor supports mount directly to floor or to floor posts.
5. Splices, including those approved for electrical continuity (bonding), as recommended by cable tray manufacturer.

B. Accessories: As required to protect, support, and install a cable tray system.

PART 3 – EXECUTION

**EXECUTION INSTALLATION – GENERAL**

3.1 INSTALLATION – COPPER UTP CABLES

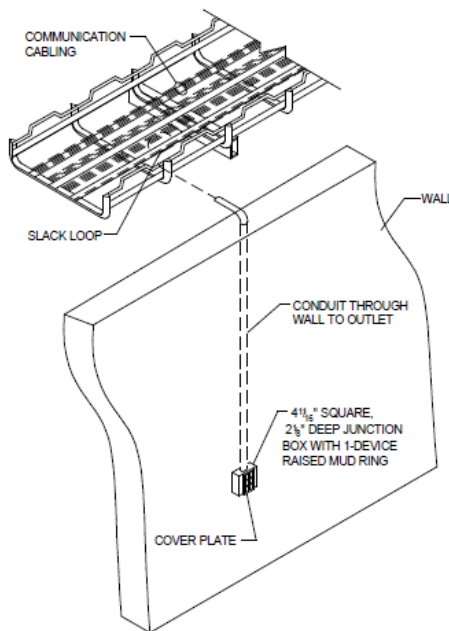
- A. Examine areas to receive communications horizontal cabling.

- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.
- D. Install communications horizontal cabling in accordance with manufacturer's instructions, ANSI/TIA-568-C.0, ANSI/TIA-568-C.1, ANSI/TIA-569-C, BICSI TDMM, and NFPA 70.
- E. Field Terminated Copper and Fiber Optic Patch Cords and Jumpers: Not allowed.
- F. Copper Patch Cords and Fiber Jumpers: Manufactured by Leviton Network Solutions.
- G. Install cables after building interior has been physically protected from weather and mechanical work likely to damage cabling has been completed.
- H. Ensure cable pathways are completely and thoroughly cleaned before installing cabling.
- I. Inspect installed conduit, wireway, cable trays, and innerduct.
- J. Clean additional enclosed raceway and innerduct systems furnished.
- K. Provide protection for exposed cables where subject to damage.
- L. Abrasion Protection:
  - 1. Provide abrasion protection for cable or wire bundles which pass through holes or across edges of sheet metal.
  - 2. Use protective bushings to protect cables.
- M. Cable Ties and Other Cable Management Clamps:
  - 1. No more than hand tightened.
  - 2. Fit snugly, but not compress, crimp, or otherwise change physical characteristics of cable jacket or distort placement of twisted-pair components.
  - 3. Replace cables exhibiting stresses due to over tightening of cable management devices.
  - 4. Use plenum-rated cable ties in plenum spaces.
  - 5. Velcro wraps are preferred over cable ties for all cable bundles. Plenum-rated Velcro wraps are available from Leviton.
- N. Where possible, route cables in overhead cable trays and inside wire management systems attached to equipment cabinets and racks.
  - 1. Use Velcro, plastic ties or ducts to restrain cabling installed outside of wire management systems on racks or in cabinets.
- O. Cable Trays: Do not exceed 50 percent fill.
- P. Cable Raceways: Do not fill greater than ANSI/TIA-569-B maximum fill for particular raceway type.
- Q. When not in horizontal cable tray, support horizontal cables at a maximum of 48-inch (1.2 to 1.5-m) irregular intervals, if J-hook or trapeze system is used to support cable bundles.



- R. Do not allow cables to rest on acoustic ceiling grids, plumbing pipes, or electrical conduits.
- S. Bundle horizontal distribution cables in groups of no more than amount of cables designed for by cable support manufacturer, based on cable OD and weight.
- T. Fire-Sprinkler System:
- U. Install cables above fire-sprinkler system.
- V. Do not attach cables to fire-sprinkler system or ancillary equipment or hardware.
- W. Install cable system and support hardware so that it does not obscure valves, fire alarm conduit, boxes, or other control devices.
- X. Do not attach cables to ceiling grid or lighting fixture wires.
- Y. Install appropriate carriers to support cabling, where support for horizontal cables are required.
- Z. Replace before final acceptance, cables damaged or exceeding recommended installation parameters during installation.
- AA. All Communication cables from horizontal cabletray to outlets must be in 1" metal conduit as shown in Figure 6.0

**FIGURE 6.0**



1. Install unshielded twisted-pair cables in accordance with manufacturer's instructions.
2. Install cables in continuous lengths from origin to destination, without splices, except for transition points or consolidation points.
3. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in enclosure intended and suitable for the purpose.

4. Cable Minimum Bend Radius and Maximum Pulling Tension:
5. Do not exceed bend radius for UTP = 4 X Cable OD, FTP = 4 X Cable OD.
6. Install unshielded twisted-pair cables so that there are no bends smaller than 4 times cable outside diameter at any point in the run and at the termination field.
7. Pulling Tension on 4-Pair UTP Cables: Do not exceed 25 ft.lb. for 4-pair UTP cable.
8. Separation from Power Lines: Provide following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:
  - a. Open or Nonmetal Communications Pathways: Electric motors, fluorescent light fixtures, and unshielded power lines carrying up to 3 kVA: 12 inches.
  - b. Electrical equipment and unshielded power lines carrying more than 5 kVA: 36 inches.
  - c. Large electrical motors or transformers: 48 inches.
9. Grounded Metal Conduit Communications Pathways:
  - a. Electrical equipment and unshielded power lines carrying up to 2 kVA: 2-1/2 inches.
  - b. Electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA: 6 inches.
  - c. Electrical equipment and unshielded power lines carrying more than 5 kVA: 12 inches.
  - d. Power lines enclosed in grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA: 3 inches.
  - e. Power lines enclosed in grounded metal conduit (or equivalent shielding) carrying more than 5 kVA: 6 inches.
  - f. Coil cables to house cable coil without exceeding manufacturer's bend radius.
  - g. In hollow wall installations where box eliminators are used, store excess wire in wall.
  - h. Store no more than 12 inches of UTP and 36 inches of fiber slack.
  - i. Loosely coil excess slack and store in ceiling above each drop location, when there is not enough space present in outlet box to store slack cables.
  - j. Dress and terminate cables in accordance with ANSI/TIA-568-C.0, ANSI/TIA- C.1, BICSI TDMM, and manufacturer's instructions.
  - k. Terminate 4-pair cables on jack and patch panels using T568-B or T568-A wiring scheme.
  - l. Pair Untwist at Termination: Do not exceed 12 mm (1/2 inch).
  - m. Bend Radius of Horizontal Cables:
    - n. Not less than 4 times OD of UTP cables.
    - o. Not less than 4 times OD of FTP cables.
  - p. Maintain cable jacket to within 25 mm (1 inch) of termination point.
  - q. Neatly bundle cables and dress to their respective panels or blocks.
    - 1) Feed each panel or block by individual bundle separated and dressed back to point of cable entrance into rack or frame.

### 3.2 INSTALLATION – OPTICAL FIBER CABLES

- A. Place fiber optic cables to maintain minimum cable bend radius limits specified by manufacturer or 15 times cable diameter, whichever is larger.
- B. Use care when handling fiber optic cables.

1. Carefully monitor pulling tension so as not to exceed limits specified by manufacturer.
- C. Do not splice horizontal fiber optic cables.

### 3.3 FIELD QUALITY CONTROL

#### **CABLES AND TERMINATION HARDWARE:**

- A. Test 100 percent for defects in installation and verify cabling system performance under installed conditions in accordance with ANSI/TIA-568-C.0.
  1. Verify all pairs of each installed cable before system acceptance.
  2. Defects in cabling system installation, including but not limited to cables, connectors, patch panels, and connector blocks shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed.
- B. Test all cables in accordance with this specification section, ANSI/TIA-568-C.2, and ANSI/TIA-568-C.3 standards, and Berk-Tek Leviton Network Solutions instructions
- C. If any of these are in conflict, bring discrepancies to the attention of the Architect for clarification and resolution.
- D. Cables, Jacks, Connecting Blocks, and Patch Panels:
  1. Verify all pairs of each installed cable before system acceptance.
  2. Defects in cabling system installation, including but not limited to cables, connectors, patch panels, and connector blocks shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed.
  3. Testing Unshielded Twisted-Pair Cables: (NOTE: Permanent Link Test results are recommended and are the expected norm – unless patch cords that will remain installed at the work area and cross-connect are also being tested, in which case Channel Test results would be expected and accepted).
    - a. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens, and performance as specified.
- E. Additional testing is required to verify Category performance.
- F. Test horizontal cabling using approved certification tester for Category 6A, Category 6, and Category 5e performance compliance in accordance with ANSI/TIA-568-C.2.

(NOTE: Appropriate Fluke, Agilent, Ideal, or JDSU certification testers may be used).
- G. Category 6A shall conform to ANSI/TIA-568-C.2 for augmented Category 6 to 500 MHz.
- H. Category 6 shall conform to ANSI/TIA-568-C.2 for Category 6 to 250MHZ
- I. Follow ANSI/TIA-568-C.2. Basic Tests Required:

1. Wire map.
2. Length (feet).
3. Insertion loss (dB), formerly attenuation.
4. NEXT (Near end crosstalk) (dB).
5. Return loss (dB).
6. ELFEXT (dB).
7. Propagation delay (ns).
8. Delay skew (ns).
9. PSNEXT (Power sum near-end crosstalk loss) (dB).
10. PSELFEXT (Power sum equal level far-end crosstalk loss) (dB).
  - a. Test Category 6A by auto test to 500 MHz.
11. Alien Crosstalk (AXT) testing and AXT test results are NOT required by Leviton or Berk-Tek for warranty of a Category 6A system. (**Note:** AXT testing may be required by the customer, in which case these tests WOULD have to be performed).
  - a. Test Category 6 by auto test to 250 MHz.
  - b. Test Category 5e by auto test to 100 MHz.
  - c. Provide test results in approved certification testers original software format on CD, with the following minimum information per cable:
12. Circuit ID.
13. Information from specified basic tests required.
14. Test Result: "Pass" or "Fail".
15. Date and time of test.
16. Project name.
17. NVP.
18. Software version.
19. An occasional asterisk-Pass (\*Pass) will be accepted by Leviton or Berk-Tek at the manufacturer's discretion, but rework of these links should be done in an attempt to achieve clean "Pass" results prior to submission of test results.
20. To receive Manufacturer's Warranty for the project, submit software copy of test results, in original tester software format, to the Owner and to the Manufacturer (either Berk-Tek or Leviton).
21. Submit fully functional version of tester software for use by the Owner in reviewing test results.
22. Report in writing to the Owner immediately, along with copy of test results, failed test results that cannot be remedied through re-termination (as in the case of reversed or split pairs).

### 3.4 TESTING OPTICAL FIBER

- A. Testing procedures shall be in accordance with the following: ANSI/TIA-568-C.3.
1. ANSI/TIA-526-7, Method B.
  2. Proposed TSB-140 Tier One Fiber Certification, C.
  3. Encircled Flux testing per the TSB-4979 and TIA-526-14-B standard.

- a. Test Equipment: Certification tester (Note: Fluke or equivalent Level III testers may be used).
- b. Testing:
  - 1) Test optical fibers at both 850 nm and 1300 nm wavelengths for multimode
  - 2) Telecommunications Room (TR) to Telecommunications Outlet (TO), Telecommunications Outlet (TO) to Telecommunications Room (TR).
  - 3) Maximum insertion loss for horizontal fiber optic cables without consolidation point: 2.0 dB.
  - 4) Test horizontal fiber runs TR to TO, TO to TR, at wavelength of operation to desktop applications.
    - a) Submit software copy of test results, in original tester software format, to the Owner and to the Manufacturer (either Berk-Tek or Leviton).

### 3.5 LABELING

- A. All labeling is to be in accordance with ANSI/TIA-606-B and manufacturer's instructions.
- B. Label horizontal cables using machine-printed label at each end of cable at approximately 12 inches from termination point and again at approximately 48 inches from termination point.  
**Handwritten Labels: Not acceptable.**
- C. Label patch panel ports and wall plate ports with cable identifier
- D. Labels: Denote TO ID and unique cable number for that TO, i.e. A-001-A for cable number 1, A-001-B for cable number 2, and so forth.
- E. Owner may provide specific labeling requirements. Coordinate with the Owner.
- F. Note labeling information on as-built drawings.

### 3.6 AS-BUILT DRAWINGS

- A. The installation contractor will be provided with 2 sets of D or E-size drawings at the start of the project. One set will be designated for as the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the build-to drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the Owner.
- B. The Contractor shall provide the central drawing set to the owner at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cabling system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

### 3.7 TEST DOCUMENTATION

- A. Test documentation shall be provided in a three-ring binder(s) within three weeks after the completion of the project. The binder(s) shall be clearly marked on the outside front cover and spine with the words "Test Results", the project name, and the date of completion (month and year). The binder shall be divided by major heading tabs, Horizontal and Backbone. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results (Category 3 or 6), fiber optic attenuation test results, OTDR traces, and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test.
- B. Scanner tests shall be printed on 8-1/2" x 11" paper. Hand written test results (attenuation results and green light results) shall be documented on the attached test form (Appendix C). OTDR test results shall be printed or attached and copied on 8-1/2" x 11" paper for inclusion in the test documentation binder.
- C. When repairs and re-tests are performed, the problem found, and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the binder.

### 3.8 CABLING SYSTEM ACCEPTANCE

- A. The Owner's Technical Representative will make periodic inspection of the project in progress. All work must be approved by Owner's Technical Representative before installation. This includes cabling tray, cable, all telecommunications room equipment, etc.

### 3.9 FINAL INSPECTION

- A. Upon completion of the project, the Owner's Technical Representative will perform a final inspection of the installed cabling system with the Contractor's Project Foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the Owner.

END OF SECTION 271500

## SECTION 271600 - TELECOMMUNICATIONS RACEWAY SYSTEM

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. General: Provide raceways, outlet boxes and accessories for the owner furnished telecommunications cabling system as directed by the equipment supplier. Coordinate with Owner and Owner's Equipment Vendor to ensure compatibility and quality of all new equipment supplied.

### PART 2 - PRODUCTS

#### 2.1 RACEWAY

- A. Provide 3/4" EMT conduit stubs from the outlets to above accessible ceilings.
- B. Voice/Data outlets shall consist of a 4-11/16" square outlet box, single gang plaster ring and 3/4" conduit turned out above nearest corridor accessible ceiling with nylon grommet on end of conduit.
- C. Provided two 4" conduit sleeves at all corridor intersections for IT cabling needs. If corridor wall is a fire rated wall provide fire rated sleeves equal to the Hilti firestop speed sleeve. Provide six additional sleeves as to what is installed.

### PART 3 - EXECUTION

#### 3.1 RACEWAY SYSTEM

- A. Install capped bushings on raceways as soon as installed. Pull strings shall be provided in all conduit to allow installation of cables.

#### 3.2 OUTLET AND PULLBOXES

- A. Provide outlet and pullboxes as indicated on the Drawings and as required for the complete installation of the systems.
- B. Bring any discrepancies found between the Specification and the Drawing immediately to attention of the Engineer. Installation and details indicated on the Drawings shall govern if they differ from the Specifications.
- C. All conduits shall be bonded to the building steel via a ground strap.

END OF SECTION 271600



## SECTION 280500 - PHYSICAL SECURITY SYSTEMS

### PART 1 – GENERAL

Includes, but not limited to keyfob/keycard systems and camera surveillance

Must integrate into our current Washington County Genetec Enterprise System and include all necessary Genetec Advantage licenses

#### 1.1 CAMERA SPECS

- A. All cameras must be AXIS IP PoE cameras. The successful contractor will determine which Axis cameras are to be installed. Each camera requires 1 Genetec Omnicast Enterprise Camera Connection, 1 Failover Connection and 1 Genetec SMA or 5 Year Enterprise Camera License.

#### 1.2 ACCESS CONTROL SYSTEM

- A. All card readers must be HID Prox Proxpoint Plus Mini Mullion Readers (color Gray). Each door requires a Genetec SMA Enterprise Reader Support for 5 Years.
- B. These are the standard hardware parts:
  - 1. Sy-Cloudlink – typically one per building can control up to 32 Mercury EP panels with total of 256 readers.
  - 2. Sy-EP1502 – 2-door network panel – supports up to 31 expansion boards
  - 3. Sy-MR52-S3 2-door expansion board
  - 4. FPO150-C8D8E4M – LifeSafety power enclosure – supports 8 12VDC locks and has space for 4 boards (any combination of Cloudlink, EP1502 and MR52-S3) this is a custom part so there is no spec sheet for it

Note each power supply must be hardwired into electrical system using a P&S Security Forked Keyed Switch single pole.

- C. Must Use Genetec Enclosures
- D. All door/magnetic locks must be 24 volt. The successful contractor will determine what locks are to be installed. A spare lock of each type will be provided to the County IT dept.

#### 1.3 CABLING

- A. Each reader and lock must be home run cabled back to IT Closet. Access control cable must contain the following four components in a single jacket (18/4, 22/4, 22/2 and 22/6 sheilded CMP). This is normally called Banana cable. Power and communication cabling shall be installed per hardware specs.
- B. Camera network cabling must be green Plenum Category 6 homerun to IT closet and terminated with the rest of the network cabling on patch panel.

- C. All cabling must be labeled as to which lock, reader, and camera they go to.
- D. All doors on the project must have a 1" conduit into the door frame whether they have locks or not. This is the responsibility of the electrical contractor on the project.
- E. Contractor shall be pre-qualified as a Genetec Genetec Unified Elite Dealer, must be within 2 hours distance and must be able to make components work into our current live system.
- F. If other Genetec parts are needed and not listed, it is the responsibility of the contractor to provide those parts.
- G. Any questions will be directed to Washington County IT. County IT also requires a final verification of a working system.
- H. These specifications supersede all other specifications for Physical Security (keyfob and camera or any other door access control)

END OF SECTION 280500

## SECTION 281000 - SECURITY RACEWAY SYSTEM

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. General: Provide raceways, outlet boxes, pull strings and accessories for the owner furnished security system as directed by the equipment supplier. Coordinate with Owner and Owner's Equipment Vendor to ensure compatibility and quality of all new equipment supplied.

### PART 2 - PRODUCTS

#### 2.1 RACEWAY

- A. Provide 3/4" EMT conduit stubs from the outlets to above accessible ceilings. Provide pull strings in raceway.
- B. Security System outlets shall consist of a outlet boxes, and 3/4" conduit turned out above accessible ceiling with nylon gromment on end of conduit.

### PART 3 - EXECUTION

#### 3.1 RACEWAY SYSTEM

- A. Install capped bushings on raceways as soon as installed.

#### 3.2 OUTLET AND PULLBOXES

- A. Provide outlet and pullboxes as indicated on the Drawings and as required for the complete installation of the systems.
- B. Bring any discrepancies found between the Specification and the Drawing immediately to attention of the Engineer. Installation and details indicated on the Drawings shall govern if they differ from the Specifications.
- C. All conduits shall be bonded to the building steel via a ground strap.

END OF SECTION 281000

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## SECTION 283111 FIRE ALARM SYSTEM

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
  - 1. Division 16: "Basic Electrical Materials and Methods."
  - 2. Division 16: "Wiring Methods."
  - 3. Division 13: "Fire Suppression".
  - 4. Division 15: "Fire Protection".
  - 5. Division 15: "HVAC Systems".
  - 6. Division 13: "Building Automation and Control".
- C. The system and all associated operations shall be in accordance with the following:
  - 1. Requirements of the following Model Building Code: IBC, 2009 Edition
  - 2. Local Jurisdictional Adopted Codes and Standards
  - 3. ADA Accessibility Guidelines

#### 1.2 SUMMARY

- A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
- B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.
- C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
  - 1. Fire alarm system detection and notification operations.
  - 2. Control and monitoring of elevators, door hold-open devices, and other equipment as indicated in the drawings and specifications.

#### 1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SCOPE OF WORK

- A. Functional Description: Provide a complete fire alarm and detection system with the following functions and operating features:
1. Signal Initiation: The activation of any manual or automatic fire alarm initiating device shall cause the following actions and indications:
    - a. The common alarm LED shall flash on the Fire Alarm Control Panel and at all Remote Annunciators as shown on the Drawings.
    - b. Display a custom message describing the device originating the alarm condition at the Fire Alarm Control Panel, the Remote Fire Alarm Control Panels and at the Remote Annunciators on the LCD alpha numeric displays. All displays shall be identical including those at the remote locations. These displays shall display the alarm condition via unique messages as required by the system Owner.
    - c. The audible notification appliances shall sound a "Synchronized" temporal pattern (Code 3) alert tone, this as outlined by NFPA 72 Section 6.8.6.4, on all the audible devices throughout the building.
    - d. The visual notification appliances shall flash throughout the building. All visual devices shall be synchronized to flash at the same time.
  2. Off Premise Transmission: Alarm, Troubles and Supervisory Alarm signals shall be transmitted to a U.L. Central Station as approved by the Authority Having Jurisdiction.
    - a. The selection of the Central Station shall be by the Owner and is not part of this Contract. However, this contractor shall coordinate the connection for this service including performing all programming of the communication device to ensure the alarm is transmitted and received by this Agency.
    - b. Off site trouble reports for primary system failure shall be automatically delayed for a period of time equal to 25% of the system standby battery capacity to eliminate spurious reports as a result of power fluctuations.
  3. Silencing: Switches shall be provided to acknowledge and silence alarm, trouble and supervisory conditions at the Fire Alarm Control Panel or at any Remote Annunciator equipped with an LCD Display. Activation of these shall silence the audible appliances and the visual appliances shall stop flashing. The alarm indication shall be transferred to a solid visual indicator on the control panel and at all remote annunciators.
    - a. The alarm signals shall resound, and strobes will continue to flash upon receipt of a subsequent alarm condition, reported by a different device.
  4. Trouble Indication: Any abnormal condition, such as loss of primary power, open circuit, or a grounded conductor shall cause the system trouble signal to sound and the trouble LED to glow indicating the type of trouble that exists. The trouble signal may be silenced by momentarily depressing the trouble silence switch, but the trouble LED shall glow until the trouble condition has been corrected. If a second trouble condition should arise, the trouble signal shall be resounded.
  5. Power Sources: The system shall normally operate from a single 120VAC 60 Hz source, however, standby batteries shall be provided to operate the system during power outages. Batteries shall be sized to operate the system in the standby mode for a minimum of 60 hours and in the alarm mode for a minimum of 5 minutes at the end of the 60 hour

- period.
6. Power Loss Indication: Sound trouble signal at the FACP upon loss of primary power at the FACP. Provide an indication at the FACP when the system is operating on an alternate power supply.
  7. Annunciation: Annunciate manual or automatic operation of any alarm or supervisory initiating device both on the FACP and on the annunciator indicating the location and type device.
  8. FACP Alphanumeric Display: Liquid crystal (LCD) display.
  9. General Alarm: A system general alarm includes:
    - a. Indicating the general alarm condition at the FACP and at all Remote Annunciators equipped with an LCD Display (Refer to the Drawings).
    - b. Display the custom message describing the device originating the condition at the Fire Alarm Control, the Remote Fire Alarm Control Panels and at the Remote Annunciators on the LCD alpha numeric displays. The custom messages shall be approved by the system Owner before programming.
    - c. Initiating audible and visible alarm signals throughout the building.
    - d. Stopping supply and return fans serving area where the alarm initiated.
    - e. Closing smoke dampers on system serving area where the alarm initiated.
    - f. Initiating smoke control sequence through a signal to the building automatic temperature control system.
    - g. Unlocking designated doors.
    - h. Initiating transmission of alarm signal to remote central station.
- B. Manual station alarm operation initiates a general alarm.
- C. Smoke Detection
1. Smoke detection initiates a general alarm.
  2. Smoke Detection for devices without Alarm Verification initiates a general alarm.
  3. Smoke Detection for a Device with Alarm Verification Causes:
    - a. Audible and visible indication "alarm verification" signal at the FACP.
    - b. Activation of a listed and approved "alarm verification" sequence at the FACP and the detector.
    - c. Recording of the event on the system printer.
    - d. General alarm initiation if the alarm is verified.
    - e. FACP indication canceled and system reset if the alarm is not verified.
  4. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, displays of their current status and sensitivity settings, and controls changes in those settings. Provide ability of using the same controls to program repetitive scheduled changes in sensitivity of specific detectors.
  5. Permissible Signal Time Elapse: The maximum permissible elapsed time between the actuation of any fire alarm or fire detection system alarm initiating device and its indication at the FACP is two seconds.
  6. Independent System Monitoring: Supervise each independent smoke detection system and duct detector for both normal operation and trouble.
  7. Circuit Supervision: Indicate circuit faults with both a device identification and a trouble signal at the FACP. Provide a distinctive indicating audible tone and (LED) indicating

light. The maximum elapsed time between the occurrence of the trouble condition and its indication at the FACP is 200 seconds.

## 1.5 SYSTEM DESCRIPTION

- A. General: Provide a complete, non-coded addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.
- B. Power Requirements
  - 1. The control unit shall receive AC power via a dedicated fused disconnect circuit.
  - 2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 5 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
  - 3. All circuits requiring system-operating power shall be 24 VDC nominal voltage and shall be individually fused at the control unit.
  - 4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously at the user interface while incoming power is present.
  - 5. The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
  - 6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control.
  - 7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
  - 8. Loss of primary power shall sound a trouble signal at the FACU. FACU shall indicate when the system is operating on an alternate power supply.
- C. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary.
  - 1. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation.
  - 2. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory.
  - 3. Panels shall be capable of full system operation during new site specific configuration download, master exec downloads, and slave exec downloads.
  - 4. Panels shall automatically store all program changes to the panel's non-volatile memory each time a new program is downloaded. A compare utility program shall also be available to authorized users to compare any two of the saved programs via programming PC. The compare utility shall provide a deviation report highlighting the changes between the two compared programs.
  - 5. Panels shall provide electronic file storage with a means to retrieve a record copy of the site-specific software. Sufficient file storage shall be provided for other related system



- documentation such as record drawings, record of completion, owner's manuals, testing and maintenance records, etc.
6. The electronic media used to store the record copy of site-specific software and other related system documentation shall be located in the fire alarm control unit.
- D. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.
- E. Wiring/Signal Transmission
1. Transmission shall be hard-wired using separate individual circuits for each zone of alarm operation, as required or addressable signal transmission, dedicated to fire alarm service only.
  2. System connections for initiating device circuits shall be Class B, Style D, signaling line circuits shall be Class B, Style 4 and notification appliance circuits shall be Class B, Style Y.
  3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACU. Provide a distinctive indicating audible tone and alphanumeric annunciation.
- F. Remote Services Access
1. Fire Alarm Control Unit (FACU) shall have the capability to provide a remote service access feature using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3. The Remote Access feature shall provide automatic notification of system faults and remote diagnostics of system status for responding technicians prior to arrival on site.
  2. A standard RJ-45 Ethernet connection shall connect to the owners Ethernet network. Provisions for that connection must be provided at each fire alarm control unit as part of the contract.
  3. The Ethernet access feature shall be agency listed for specific interfaces and for the purpose described in this section. The use of non-listed external third party interfaces is not acceptable.
  4. The internet remote access service function shall provide automated real time off-site reporting of discrete system events to a remote service support center with details of internal FACU fault conditions allowing a pre-site visit analysis of repair requirements.
  5. Existing FACU controls shall be capable of retrofitting the Remote Service module as a plug-in upgrade feature.
  6. The remote service network shall work on the customers Ethernet infrastructure and be Fire- Wall friendly for two-way communications for off-site reporting. The feature shall be compatible with existing proxy servers and firewalls shall not require any special changes or modifications.
  7. The remote service system shall be able to connect to the remote service center without the need for a VPN account or similar tunnel.
  8. The remote service system shall be a non-Windows based application to protect against conventional virus attacks.
  9. The remote service system shall support a secure connection with strong encryption, 128 bit or better, and an optional secondary encryption method if required.
  10. The remote service system shall be compatible with virtual LANS (VLAN).
  11. The remote service system shall work on an outbound communication premise (panel calls home) in order to eliminate the possibility of any inbound connection into the

- network (from trusted or non-trusted sites).
12. The remote service system shall provide an audit trail of all events and service connections.
  13. The Remote Service connection will provide access for panel software downloads and uploads for archiving job specific programs back at the enterprise server.
  14. The supplier shall provide a service contract for the Remote Service program that provides the following requirements:
    - a. 24/7 recording of FACU service activity.
    - b. Off-site diagnostics by a technical specialist to provide repair and parts guidance to the service technician prior to a site visit.

G. Required Functions: The following are required system functions and operating features:

1. Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
2. Noninterfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACU after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.
3. Transmission to an approved Supervising Station: Automatically route alarm, supervisory, and trouble signals to an approved supervising station service provider, under another contract.
4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACU and the remote annunciator, indicating the type of device, the operational state of the device (i.e. alarm, trouble or supervisory) and shall display the custom label associated with the device.
5. Selective Alarm: A system alarm shall include:
  - a. Indication of alarm condition at the FACU and the annunciator(s).
  - b. Identification of the device /zone that is the source of the alarm at the FACU and the annunciator(s).
  - c. Operation of audible and visible notification appliances until silenced at FACU.
  - d. Unlocking designated doors.
  - e. Shutting down supply and return fans serving zone where alarm is initiated.
  - f. Closing smoke dampers on system serving zone where alarm is initiated.
  - g. Transmission of signal to the supervising station.
6. Supervisory Operations: Upon activation of a supervisory device such as a tamper switch, the system shall operate as follows:
  - a. Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.
  - b. Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
  - c. Record the event in the FACU historical log.

- d. Transmission of supervisory signal to the supervising station.
  - e. Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.
- 7. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.
- 8. System Reset
  - a. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-arming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
  - b. Should an alarm condition continue, the system will remain in an alarmed state.
- 9. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.
- 10. WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:
  - a. The city circuit connection and any suppression release circuits shall be bypassed for the testing group.
  - b. Control relay functions associated with one of the 8 testing groups shall be bypassed.
  - c. The control unit shall indicate a trouble condition.
  - d. The alarm activation of any initiating device in the testing group shall cause the audible notification appliances assigned only to that group to sound a code to identify the device or zone.
  - e. The unit shall automatically reset itself after signaling is complete.
  - f. Any opening of an initiating device or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.
- 11. Install Mode: The system shall provide the capability to group all non-commissioned points and devices into a single "Install Mode" trouble condition allowing an operator to clearly identify event activations from commissioned points and devices in occupied areas.
  - a. It shall be possible to individually remove points from Install Mode as required for phased system commissioning.
  - b. It shall be possible to retrieve an Install Mode report listing that includes a list of all points assigned to the Install Mode. Panels not having an install mode shall be reprogrammed to remove any non-commissioned points and devices.

#### H. Analog Smoke Sensors

- 1. Monitoring: FACU shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored

- values.
2. Environmental Compensation: The FACU shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
  3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACU.
  4. Sensitivity Testing Reports: The FACU shall provide sensor reports that meet NFPA 72 calibrated test method requirements.
    - a. Reports shall be capable of being printed for annual recording and logging of the calibration maintenance schedule.
    - b. Where required, reports shall be accessible through download to a USB drive where they can be printed on a PC printer.
  5. The FACU shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACU as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACU and subsequently a system trouble is reported. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.
  6. The FACU shall continuously perform an automatic self-test on each sensor that will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
  7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft. obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
  8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
  9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.
- I. Fire Suppression Monitoring
1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
  2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
  3. Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.

- J. Audible Alarm Notification: By horns in areas as indicated on drawings.

## 1.6 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
  2. Wiring diagrams from manufacturer.
  3. Shop drawings showing system details including location of FACU, all devices, circuiting and details of graphic annunciator.
  4. System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate in accordance with the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
  5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, SLC, NAC, relay, sensor, and auxiliary control circuits.
  6. Operating instructions for FACU.
  7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
  8. Product certification signed by a certified representative of the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
  9. Record of field tests of system.
- B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions, if required, to make clarifications or revisions to obtain approval.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A factory authorized installer is to perform the work of this section.
- B. Each and every item of the Fire Alarm System shall be listed under the appropriate category by a Nationally Recognized Testing Laboratory and shall bear the respective "NRTL" label.

## 1.8 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
  - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

#### 1.9 MAINTENANCE SERVICE

- A. Warranty Maintenance Service: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives
- B. Basic Services: Routine maintenance visits on an "as needed" basis at times scheduled with the Owner. Respond to service calls within 24 hours of notification of system trouble either by customer visit or other customer contact as necessary. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.
- C. Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.
- D. Maintenance Service Contract: No later than 60 days prior to the expiration of the warranty maintenance services, deliver to the Owner a proposal to provide contract maintenance and repair services for an additional one-year term. As an option with this proposal, deliver to the Owner a proposal to provide scheduled inspection and testing services for a one-year term. Owner will be under no obligation to accept maintenance service contract proposal or inspection and testing proposal.

#### 1.10 EXTRA MATERIALS

- A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:
  - 1. Break Rods for Manual Stations: Furnish quantity equal to 15 percent of the number of manual stations installed; minimum of 6 rods.
  - 2. Notification Appliances: Furnish quantity equal to 10 percent of each type and number of units installed, but not less than one of each type.
  - 3. Smoke Detectors or Sensors, Fire Detectors, and Flame Detectors: Furnish quantity equal to 10 percent of each type and number of units installed but not less than one of each type.
  - 4. Detector or Sensor Bases: Furnish quantity equal to 2 percent of each type and number of units installed but not less than one of each type.
  - 5. Printer Ribbons: Furnish 6 spare printer ribbons when a printer is provided.

## PART 2 PRODUCTS

### 2.1. ACCEPTABLE EQUIPMENT AND SERVICE PROVIDERS

- A. Manufacturers: The equipment and service described in this specification are those supplied and supported by Tyco SimplexGrinnell and represent the base bid for the equipment.
  - 1. Subject to compliance with the requirements of this specification, provide products by one of the following:
    - a. Simplex, a Tyco Company
    - b. Siemens
    - c. Edwards
- B. Being listed as an acceptable Manufacturer in no way relieves obligation to provide all equipment and features in accordance with these specifications.
- C. Alternate products must be submitted to the Engineer two weeks prior to bid for approval. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
- D. The equipment and service provider shall be a nationally recognized company specializing in fire alarm and detection systems. This provider shall employ factory trained and NICET Level III certified technicians and shall maintain a service organization within 100 miles of this project location. The equipment and service provider shall have a minimum of 10 years experience in the fire protective signaling systems industry.

### 2.2. SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
  - 1. Manual stations.
  - 2. Heat detectors.
  - 3. Smoke detectors.
  - 4. Duct smoke detectors.
  - 5. Verified automatic alarm operation of smoke detectors.
  - 6. Automatic sprinkler system water flow.
  - 7. Fire-extinguishing system operation.
  - 8. Fire standpipe system.
- B. Fire-alarm signal shall initiate the following actions:
  - 1. Continuously operate alarm notification appliances.
  - 2. Identify alarm at fire-alarm control unit and remote annunciators.
  - 3. Transmit an alarm signal to the remote alarm receiving station.
  - 4. Unlock electric door locks in designated egress paths.
  - 5. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
  - 6. Close smoke dampers in air ducts of designated air-conditioning duct systems.

7. Activate emergency lighting control.
  8. Activate emergency shutoffs for gas and fuel supplies.
  9. Record events in the system memory.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
  2. Low-air-pressure switch of a dry-pipe sprinkler system.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
  2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
  3. Loss of primary power at fire-alarm control unit.
  4. Ground or a single break in fire-alarm control unit internal circuits.
  5. Abnormal AC voltage at fire-alarm control unit.
  6. Break in standby battery circuitry.
  7. Failure of battery charging.
  8. Abnormal position of any switch at fire-alarm control unit or annunciator.
  9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer where provided.
- 2.3. FIRE ALARM CONTROL UNIT
- A. General: Comply with UL 864, "Control Units and Accessories for Fire Alarm Systems".
- B. The following FACU hardware shall be provided:
1. Power Limited base panel with platinum cabinet and door, 120 VAC input power.
  2. Capability to support up to 400 I/O points including up to 250 standard addressable devices (single and multi-point) and up to 32 non-addressable zones (IDC's).
  3. 400 points of annunciation where one (1) point of annunciation equals:
    - a. 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
    - b. 1 LED on panel or 1 switch on panel.
  4. 4 Amp Power Supply minimum with temperature compensated, dual-rate battery charger capable of charging up to 33 Ah batteries without a separate external battery charger. Battery charger voltage and amperage values shall be accessible on the FACU LCD display.
  5. 2 Amp Auxiliary Power output with electronic overload protection, automatic restoral, and programmable operation for four-wire detector reset operation.
  6. Addressable device capacity shall be a minimum of 100 addressable points of manual pull stations, automatic heat or smoke detectors, addressable monitor an/control modules of any individual device limit up to the capacity of the SLC.



7. Optional SLC expander modules shall be available to increase the panel capacity to the full capacity of 250. These shall be in increments of 75 points and shall allow these additional points to be on separate isolated SLC loops (up to three). This point mix can be spread across the isolated loops as desired, i.e. 185, 65, 0.
  8. Panel shall be capable of adding 32 conventional zone circuits to connect to existing system devices for ease in retrofit applications.
  9. Four (4) Class B or A Notification Appliance Circuits (NAC; rated 3A@24VDC, resistive). As an option, each NAC shall be configurable for use as auxiliary power taps to control non- reverse polarity devices. Maximum current rating is 2 Amps when used to control auxiliary devices powered from the 24 VDC auxiliary power output.
  10. One (1) Class B or Class A addressable notification appliance Signaling Line Circuits (SLC; rated 3A @ 29VDC, resistive). Addressable notification SLC shall maintain a constant 29 volts during full alarm, trouble, or standby battery operation. Up to 127 addressable notification appliances shall be supported on SLC.
  11. Eight point IDC/Auxiliary Relay Circuits module. Each point shall be selectable as an IDC input or Relay output (Form C contacts rated 2A @ 30VDC, resistive). Relay operation is programmable for trouble, alarm, supervisory of other fire response functions and selectable as normally open or normally closed.
  12. Conventional NAC's and IDC's shall provide programmable EOL values from a wide range of resistance values for retrofit convenience.
  13. Remote Unit Interface: supervised Class B (Style 4) or Class X (Style 7) signaling line circuit (SLC) for control and monitoring of remotely located annunciators and I/O modules.
  14. Programmable DACT for per Point Reporting.
  15. Alarm Relay Module shall provide three Form C relays that are used for Alarm, Trouble, and Supervisory, rated 2 A resistive @ 32 VDC.
- C. Module level ground fault searching shall be provided to assist installation and service personnel by locating and isolating modules with grounded wiring.
- D. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure.
- E. Alphanumeric Display and System Controls: The user interface shall be a 4.3" diagonal color touchscreen LCD with separate status LEDs for Alarm (red), Priority 2 (red), Supervisory (yellow), Trouble (yellow), Alarm Silenced (yellow) and AC Power (green).
1. The Touchscreen LCD display shall indicate alarm, supervisory, and component status messages and shall include capability for entering and executing control commands through a convenient and detailed operator information display.
  2. The display shall display two individual conditions including all information associated for the conditions with the ability to scroll up or down for display of multiple system conditions. Alarms, Priority 2, Supervisory, and Troubles shall be able to be displayed individually by display press activation of each specific condition.
  3. The operator display shall utilize a logical, menu-driven touchscreen display with password access control. All system operator functions shall be available through this display. Display shall support dual language selection, including Unicode character language sets.
  4. Alarm, Priority 2, Supervisory, Trouble, and Alarm Silenced conditions shall be indicated by dedicated LED's and a tone-alert audible indication. Each condition will cause the display to present a dedicated acknowledge push-button "switch" that shall

- silence the tone-alert but shall leave the LED on until all conditions in that category are restored to normal.
5. To conserve power, when the display has not been touched and no new system status has occurred for 60 seconds, the back light shall dim to 20% of normal brightness. If there is no activity in the system (System is Normal), the standby screen shall display the current time and date to verify proper operation. If an event occurs and the screen is touched, the backlight shall return to full intensity.
  6. Three programmable control switches with status LED's and provisions for custom labeling shall be provided as part of the display. The display menu shall provide a lamp test feature that when selected, shall activate the panel LED's for 5 seconds. Dual-color LED's shall blink alternately.
  7. The display shall support a custom background image that can be displayed on each of the remote color touchscreen annunciators when status is normal. File types supported shall be JPG, BMP, GIF, and PNG. Image type is to be JPG, and minimum image size shall be 480 x 240, with a file size limit of 100 kb.
  8. Password access shall provide for; System Information, Panel Setup, Alarm and Trouble Logs, Reset, Diagnostics, setting User Access Level, Lamp Test and Reports Menu. User password access shall be programmable.
  9. Alarm and Trouble History Logs (up to 1000 entries for each, 2000 total events) shall be available for viewing from the display or available to be downloaded to USB drive where it can be inserted into a PC for printing.

## 2.4. ADDRESSABLE INITIATING

### A. Addressable Manual Pull Stations

1. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
2. Description: Addressable single- action type, red LEXAN. Station shall mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units. Station shall be pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit. Where double-action stations are provided, the mechanism shall require two actions push top activation door to initiate an alarm.
3. Provide with a front showing red LED showing that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the station LED shall be on steady.
4. Indoor Protective Shield: Where required, or as indicated on the drawings, provide a factory- fabricated, tamperproof, clear LEXAN enclosure shield and red frame that easily fits over manual pull stations which shall be hinged at the top to permit lifting for access to initiate a local alarm. Unit shall be NRTL listed.

### B. Addressable Analog Smoke Sensors

1. General Requirements for System Smoke Detectors
  - a. Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:

- b. Factory Nameplate: Serial number and type identification.
- c. Operating Voltage: 24 VDC, nominal and shall be two-wire type.
- d. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
- e. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. Provide terminals in the fixed base for connection to building wiring. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit. Sensors shall include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACU. Sensor address shall be located in base to eliminate false addressing when replacing sensors. Integral Addressable Module shall be arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Each sensor base shall contain an integral visual-indicating LED for communication and alarm indication status.
- f. Each sensor base shall contain a magnetically actuated test switch to provide for easy pre-certification alarm testing at the sensor location.
- g. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor but shall indicate a "Wrong Device" trouble condition.
- h. Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit. Provide multiple levels of detection sensitivity for each sensor.
- i. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACU.
- j. The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI. Removal of the sensor head for cleaning shall not require the setting of addresses.
- k. Bases: CO Sensor, relay output, sounder and isolator bases shall be supported alternatives to the standard base.

2. Addressable Sensor Bases

- a. Standard base - Twist lock addressable base with address selection DIP switch accessible from front with sensor removed. Integral red LED for power-on (pulsing), or alarm or trouble (steady on). Locking anti-tamper design mounts on standard outlet box.
- b. Sensor Base with remote device connection - All standard base features with wired connection for either a Remote LED alarm indicator or remote relay (relay is unsupervised and requires separate 24VDC)
- c. Supervised Relay Bases - All standard base features and shall be available in either a 4-Wire Sensor Base to use with remote or locally mounted relay; requires

separate 24 VDC, or as a 2-Wire Sensor Base to use with remote or locally mounted relay; no separate power required. Supervised relay operation shall be programmable and shall be manually operated from control panel.

- d. Sensor base with built-in electronic alarm sounder - All standard base features and piezoelectric sounder shall provide high output (88 dBA) with low current requirements (20 mA). Sounder shall be synchronized via SLC communications or by the NAC if NAC powered, sounder shall operation shall be programmable and shall be manually operated from control panel.

C. Addressable Duct Smoke Sensor

- 1. Standard Addressable Duct Smoke Sensor Unit. Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Duct housing shall include relay or relay driver as required for fan shutdown.
  - a. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACU.
  - b. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable independent of the sensor head for activation by other alarm initiating devices within the fire alarm system. Relay shall be mounted within 3 feet of HVAC control circuit.
  - c. Duct Housing shall provide a magnetic test area and Red sensor status LED and Duct Housing shall provide a relay control Yellow LED trouble indicator.
  - d. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
  - e. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
  - f. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
  - g. Each duct smoke sensor shall be provided with a Remote Test Station with an alarm LED and test switch.
  - h. Where indicated provide a NEMA 4X weatherproof duct housing enclosure that shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

D. Addressable Heat Sensors

- 1. General Requirements for Heat Detectors: Comply with UL 521.
- 2. Thermal Sensor Combination type: Fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
- 3. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor- based, rate-compensated, self-restoring and shall not be affected by thermal lag. Selectable rate compensated, fixed temperature sensing with or without rate-of-rise operation.

4. Mounting: Twist-lock base interchangeable with smoke-sensor heads.
5. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
6. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACU for either 15-deg F or 20-deg F per minute.
7. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.
8. Unless otherwise indicated, sensors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for temperature by fire-alarm control unit.
  - a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
  - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).

E. Addressable Multi-Point/Multi-Sensor/Multi-Criteria Sensor

1. Smoke and heat sensing shall be available to be combined in a single housing to provide smoke activity accurately monitored by photoelectric sensing technology and thermal activity accurately monitored by thermistor sensing technology.
2. A correlation algorithm of smoke activity and thermal activity shall be provided for intelligent fire detection earlier than with either technology activity alone but shall provide software and programming capabilities to help reduce nuisance alarms.
3. Individual sensor information shall be processed by the host fire alarm control panel to determine sensor status and to determine whether conditions are normal, off-normal, or alarm.
4. Analog information from each sensor type shall be digitally communicated to the control panel where it is to be analyzed. Photoelectric sensor input is to be stored and tracked as an average value with an alarm or abnormal condition being determined by comparing the sensor's present value against its average value. Thermal data is to be processed to look for absolute or rate-of-rise temperature as desired.
5. Monitoring each photoelectric sensor's average value shall provide a software filtering process that compensates for environmental factors (dust, dirt, etc.) and component aging, which shall provide an accurate reference for evaluating new activity. The intent of this process is to be a significant reduction in the probability of false or nuisance alarms caused by shifts in sensitivity, either up or down. Status indications of dirty and excessively dirty shall be automatically generated allowing maintenance to be performed on a per device basis.
6. Peak activity per sensor shall be stored by the host fire alarm control panel to assist in evaluating specific locations where the alarm set point for each sensor shall be capable of being determined at the control panel, and selectable as more or less sensitive as the individual application requires.
7. Alarm set points shall be programmed for timed automatic sensitivity selection (such as more sensitive at night, less sensitive during day). Control panel programming shall also provide multi-stage operation per sensor, for example a 0.2% level may cause a warning to prompt investigation while a 2.5% level may initiate an alarm.
8. Combination smoke and heat sensors Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute. The

fixed- temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire- alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).

9. Bases: CO Sensor, relay output, sounder and isolator bases shall be supported alternatives to the standard base.

F. Addressable Circuit Interface Modules

1. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems.
2. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.
3. There shall be the following types of modules:

a. Type 1: Monitor Circuit Interface Module

- 1) For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACU.
- 2) For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACU.

b. Type 2: Line Powered Monitor Circuit Interface Module

- 1) This type of module is an individually addressable module that has both its power and its communications supplied by the two wire signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACU.
- 2) This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.

c. Type 3: Single Address Multi-Point Interface Modules

- 1) This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.
- 2) This dual point module shall provide a supervised multi-state input and a

relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.

- 3) This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.

d. Type 4: Line Powered Control Circuit Interface Module

- 1) This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.

e. Type 5: 4-20 mA Analog Monitor Circuit Interface Module

- 1) This module shall communicate the status of a compatible 4-20 mA sensor to the FACU. The FACU shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.

4. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACU. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

## 2.5. CONVENTIONAL NOTIFICATION

### A. Standard Alarm Notification Appliances

1. Horn: Piezoelectric type horn shall be listed to UL 464. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The horn shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings.
2. Visible/Only: Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 30cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.
3. High Intensity Visible/Only: High Intensity Visible/Only: Visible/Only: Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O appliance shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 135cd, 177cd and 185cd. Provide a label inside the strobe lens to indicate the listed candela

- rating of the specific Visible/Only appliance.
4. Audible/Visible: Combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings.
  5. High Intensity Audible/Visible: Combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Strobe appliances shall be provided with different minimum flash intensities of 135cd, 177cd and 185cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The audible/visible appliance shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings.
  6. Multi-Tone Audible Only: Multi-tone appliance shall be listed to UL 464. Per appliance tone selection of 520 Hz Horn, Broadband Horn, Bell, Chime, High/Low, Slow Whoop, or Siren shall be selected using an on-board DIP Switch. Output level shall be selectable as high or low. 520 Hz tone shall be compliant with NFPA 72 Low Frequency Signal Requirements for Sleeping Areas. For ease of installation the appliance shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings.
  7. Multi-Tone Audible/Visible: Combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system and shall be provided with different minimum flash intensities of 15cd, 30cd, 75cd, 110cd, 135, and 185 candela. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. Multi-tone appliance shall be listed to UL 464. Per appliance tone selection of 520 Hz Horn, Broadband Horn, Bell, Chime, High/Low, Slow Whoop, or Siren shall be selected using an on-board DIP Switch. Output level shall be selectable as high or low. 520 Hz tone shall be compliant with NFPA 72 Low Frequency Signal Requirements for Sleeping Areas. For ease of installation the appliance shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings.
  8. Weatherproof Visible Only: Weatherproof strobe shall be UL 1971 listed for indoor applications with strobe intensity selectable as 15, 60, or 75 cd or UL 1638 listed for outdoor applications with strobe rated at 75 cd (WP75). The appliances shall be acceptable for indoor and outdoor, extended temperature and extended humidity applications. The V/O device shall consist of a xenon flash tube and associated lens/reflector system, weatherproof cover and weatherproof mounting box. The Candela levels shall be selectable by using a hardware selector on the appliance.
  9. Weatherproof Audible/Visible: Weatherproof horn/strobe shall be UL 464 and UL 1971 listed for indoor applications with strobe intensity selectable as 15, 60, or 75 cd or UL 1638 listed for outdoor applications with strobe rated at 75 cd (WP75). The appliances shall be acceptable for indoor and outdoor, extended temperature and extended humidity applications. The A/V device shall consist of a xenon flash tube and associated lens/reflector system, weatherproof cover and weatherproof mounting box. The Candela levels shall be selectable by using a hardware selector on the appliance. The Horn shall support Temporal Code 3, March Time (20, 60, or 120 BPM), Continuous, and Temporal Code 4 coding patterns. The horn shall have a minimum sound pressure level of 79 dBA for coded operation at 24 VDC.



10. Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with a Temporal Code Pattern operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided.
11. Accessories: The contractor shall furnish any necessary accessories.

B. NAC Power Extender

1. The SLC NAC Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be Class B, Style Y rated at 2 amps each. Panel shall provide capability to be expanded to 8 notification appliance circuits.
2. The internal power supply and battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.
3. The NAC extender panel may be mounted close to the host control unit or can be remotely located. The SLC Addressable NAC Extender Panel when connected to an addressable panel shall connect to the host panel via an IDNet communications channel. Via the IDNET channel each output NAC can be individually controlled for general alarm or selective area notification.
4. For SLC connected NAC extender panels up to five panels can be connected on a single SLC channel.
5. When connected to a conventional (non-addressable panel) one or two standard notification appliance circuits from the main control unit may be used to activate all the circuits on the NAC power extender panel.
6. Alarms from the host fire alarm control unit shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.

2.6. REMOTE COLOR LCD TOUCHSCREEN ANNUNCIATOR

- A. Provide a remote Color Touch screen LCD Annunciator, where required, with the same "look and feel" as the FACU operator interface. The Remote LCD Annunciator shall use the same Primary Acknowledge, Silence, and Reset Keys; Status LEDs and Color LCD Touch screen Display as the FACU.
- B. Annunciator shall be a 4.3" diagonal Color Touchscreen LCD with separate status LEDs for Alarm (red), Priority 2 (red), Supervisory (yellow), Trouble (yellow), Alarm Silenced (yellow) and AC Power (green).
- C. The annunciator shall indicate alarm, supervisory, and component status messages and shall include capability for entering and executing control commands through a convenient and detailed operator information display.
- D. The annunciator shall display two individual conditions including all information associated for the conditions with the ability to scroll up or down for display of multiple system conditions. Alarms, Priority 2, Supervisory, and Troubles shall be able to be displayed individually by display press activation of each specific condition.

- E. Annunciator Touchscreen display access shall be controlled by a key switch with a key that shall be removable only in the disabled position. User Access shall be configurable per annunciator.
- F. When the key switch is activated, system status indications shall be displayed as they occur with individual point detail as programmed at the control panel. Soft keys shall be displayed to allow user actions.
- G. The annunciator shall utilize a logical, menu-driven touchscreen display with password access control. All system operator functions shall be available through this display. Display shall support dual language selection, including Unicode character language sets.
- H. Alarm, Priority 2, Supervisory, Trouble, and Alarm Silenced conditions shall be indicated by dedicated LED's and a tone-alert audible indication. Each condition will cause the display to present a dedicated acknowledge push-button "switch" that shall silence the tone-alert but shall leave the LED on until all conditions in that category are restored to normal.
- I. To conserve power, when the annunciator has not been touched and no new system status has occurred for 60 seconds, the back light shall dim to 20% of normal brightness. If there is no activity in the system (System is Normal), the standby screen shall display the current time and date to verify proper operation. If an event occurs, or if the key switch is activated and the screen is touched, the backlight shall return to full intensity.
- J. Three programmable control switches with status LED's and provisions for custom labeling shall be provided as part of the annunciator. The display menu shall provide a lamp test feature that when selected, shall activate the panel LED's for 5 seconds. Dual-color LED's shall blink alternately.
- K. The annunciator shall support a custom background image that can be displayed on each of the remote color touchscreen annunciators when status is normal. File types supported shall be JPG, BMP, GIF, and PNG. Image type is to be JPG, and minimum image size shall be 480 x 240, with a file size limit of 100 kb.
- L. Password access shall provide for; System Information, Panel Setup, Alarm and Trouble Logs, Reset, Diagnostics, setting User Access Level, Lamp Test and Reports Menu. User password access shall be programmable.
- M. Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge, Silence and Reset operation shall be the same as the FACU.
- N. Data communications to the fire alarm control unit shall require a single unshielded twisted pair that supports other annunciators on the same communications channel. 24VDC operating power shall be provided from the fire alarm control unit.
- O. Surface, Semi-flush, and flush mounting options shall be available. Paint finish to match fire alarm control unit.

2.7. GRAPHIC ANNUNCIATOR - LED TYPE

- A. Annunciator Unit, zoned system: Provide an LED-indicating light located on the floor plan for

each zone. Mark zone boundaries on the annunciator floor plan.

- B. Annunciator Unit, addressable system: Provide an LED-indicating light located on the floor plan for each device indicating the type of device and floor on which a signal was actuated.
- C. Provide individual LED indicators for each alarm and supervisory device or zone and a LED to indicate system trouble. Additional LEDs indicate normal power and emergency power modes for the system. A toggle or push-button switch tests the LEDs mounted on the unit. The test switch does not require key operation.
- D. Enclosure: Finish to match Fire Alarm Control Units. The locking cover/display assembly is hinged on the left. Key and lock shall be common to all secured fire alarm system enclosures.

## 2.8. DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
  - 1. Verification that both telephone lines are available.
  - 2. Programming device.
  - 3. LED display.
  - 4. Manual test report function and manual transmission clear indication.
  - 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
  - 1. Address of the alarm-initiating device.
  - 2. Address of the supervisory signal.
  - 3. Address or loss of power.
  - 4. Low battery.
  - 5. Abnormal test signal.
  - 6. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.9. EMERGENCY POWER SUPPLY

- A. General: Components include battery, charger, and an automatic transfer switch.
- B. Battery: Sealed lead-acid or nickel cadmium type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 4 hours.

2.10. DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
  - 1. Factory fabricated and furnished by manufacturer of device.
  - 2. Finish: Paint of color to match the protected device.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.
- B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
  - 1. Factory trained and certified personnel.
  - 2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
  - 3. Personnel licensed or certified by state or local authority.

3.2 EQUIPMENT INSTALLATION

- A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, ethernet drops, and all other necessary material for a complete operating system.
- B. Existing Fire Alarm Equipment shall be maintained fully operational until the new equipment has been tested and accepted.
- C. Equipment Removal: After acceptance of the new fire alarm system, disconnect and remove the existing fire alarm equipment and restore damaged surfaces. Package operational fire alarm and detection equipment that has been removed and deliver to the Owner. Remove from the site and legally dispose of the remainder of the existing material.
- D. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.

- E. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.
- F. Install manual station with operating handle 48 inches (1.22 m) above floor. Install wall mounted audible and visual notification appliances not less than 80 inches (2.03 m) above floor to bottom of lens and not greater than 96 inches (2.44 m) above floor to bottom of lens.
- G. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
- H. Make conduit and wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control units, and duct smoke detectors.
- I. Automatic Detector Installation: Conform to NFPA 72.
- J. Ethernet Drop: A standard RJ-45 Ethernet connection to the owner's Ethernet network shall be provided at each fire alarm control unit as part of the contract.

### 3.3 PREPARATION

- A. Coordinate work of this Section with other affected work and construction schedule.

### 3.4 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.
- B. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- C. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
- D. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke- control system panel.
- E. Smoke dampers in air ducts of designated air-conditioning duct systems.
- F. Alarm-initiating connection to activate emergency lighting control.
- G. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
- H. Supervisory connections at valve supervisory switches.
- I. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.

### 3.5 WIRING INSTALLATION

- A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).
- B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.
- C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.
- D. Mount end-of-line device in box with last device or separate box adjacent to last device for Class "B" supervision.
- E. Ethernet Circuits
  - 1. Ethernet circuits shall be provided to the Fire Alarm Control Panel as shown on the plans.
  - 2. Where a dedicated Fire Alarm Ethernet LAN is specified only Agency Listed Fire Alarm Ethernet hardware shall be installed.
  - 3. The electrical contractor shall coordinate and ensure proper Ethernet connections occur at the fire alarm control panel prior to system turnover.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

### 3.7 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

### 3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
- B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:

1. Factory trained and certified.
  2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
  3. International Municipal Signal Association (IMSA) fire alarm certified.
  4. Certified by a state or local authority.
  5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
- C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
- D. Inspection
1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
  2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- E. Acceptance Operational Tests
1. Perform operational system tests to verify conformance with specifications:
    - a. Each alarm initiating device installed shall be operationally tested. Each device shall be tested for alarm and trouble conditions. Contractor shall submit a written certification that the Fire Alarm System installation is complete including all punch-list items. Test battery operated emergency power supply. Test emergency power supply to minimum durations specified. Test Supervising Station Signal Transmitter. Coordinate testing with Supervising Station monitoring firm/entity.
    - b. Test each Notification Appliance installed for proper operation. Submit written report indicating sound pressure levels at specified distances.
    - c. Test Fire Alarm Control Unit and Remote Annunciator.
  2. Provide minimum 10 days notice of acceptance test performance schedule to Owner, and local Authority Having Jurisdiction.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Use NFPA 72 Forms for documentation.
- H. Final Test, Record of Completion, and Certificate of Occupancy
1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy. Provide completed NFPA 72 Record of Completion form to Owner and AHJ.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

3.10 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.
- B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound pressure levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.11 TRAINING

- A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
  - 1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.
  - 2. Schedule training with the Owner at least seven days in advance.

END OF SECTION 283111



## SECTION 31 10 00 SITE CLEARING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Remove surface debris within the property.
- B. Remove designated paving, curbs, and sidewalk.
- C. Clear site of vegetation and grass.
- D. Remove trees and shrubs.
- E. Remove root system of trees and shrubs.
- F. Topsoil excavation.

#### 1.2 RELATED SECTIONS

- A. Section 31 22 13 - Rough Grading.

#### 1.3 REGULATORY REQUIREMENTS

- A. Conform to applicable code for disposal of debris, and use of herbicides
- B. Coordinate clearing Work with utility companies.

### PART 2 PRODUCTS

NOT USED

### PART 3 EXECUTION

#### 3.1 PREPARATION

- A. Verify that existing vegetation designated to remain, is tagged or identified.

#### 3.2 PROTECTION

- A. Locate, identify, and protect utilities that remain, from damage.
- B. Protect trees, shrubs, and features designated to remain, as final landscaping.
- C. Protect bench marks and property corners and existing structures from damage or displacement.

#### 3.3 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove paving, curbs, and sidewalks.

- C. Remove trees and shrubs within marked areas indicated. Remove stumps, main root ball, and root system to a depth of 12 inches or as directed by the geotechnical engineer.
- D. Clear undergrowth and deadwood, without disturbing subsoil.

### 3.4 REMOVAL

- A. Remove debris, rock, and extracted vegetation from site.

### 3.5 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded.
- B. Stockpile in area designated on site to depth not exceeding 8 feet. Protect from erosion. Remove excess topsoil not being reused at no expense to the Owner.
- C. Do not excavate wet topsoil.

END OF SECTION

## SECTION 31 13 00 RIGID PAVING

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Concrete sidewalks and exterior stair steps, fence post foundations, integral curbs, gutters, parking areas and pads as detailed in the plans.
- B. Aggregate base course.

#### 1.02 RELATED SECTIONS

- A. Section 31 23 23.13 – Backfilling.

#### 1.03 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- C. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- D. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- E. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
- F. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- G. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- H. ASTM C33 - Concrete Aggregates.
- I. ASTM C94 - Ready Mix Concrete.
- J. ASTM C150 - Portland Cement
- K. ASTM C260 - Air-Entraining Admixtures for Concrete.
- L. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- M. ASTM C494 - Chemical Admixtures for Concrete.
- N. FS TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.

#### 1.04 PERFORMANCE REQUIREMENTS

- A. Area Paving: At dumpster and loading docks, design for heavy duty commercial vehicles.

#### 1.05 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data on joint filler admixtures curing compounds.

#### 1.06 QUALITY ASSURANCE

- A. Perform work in accordance with project requirements and the Maryland State Highway Administration, which ever is more stringent.
- B. Obtain cementitious materials from same source throughout.

#### 1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable standards for paving work on public property and Maryland State Highway requirements.

#### 1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

### PART 2 PRODUCTS

#### 2.01 FORM MATERIALS

- A. Form Materials: As specified in Section.
- B. Joint Filler: Flexible foam expansion joint filler complying with ASTM D1752, Sections 5.1 through 5.4; 2 inch thick, equal to Ceramor by W. R. Meadows with water absorption of 0.24% of volume as tested in accordance with ASTM D545.

#### 2.02 REINFORCEMENT

- A. Reinforcing Steel and Wire Fabric: Type specified in Section.
- B. Dowels: ASTM A615; 60 ksi yield grade, plain steel, unfinished finish.

#### 2.03 CONCRETE MATERIALS

- A. Concrete Materials: As specified in Section.
- B. Fine and Coarse Mix Aggregates: ASTM C33.
- C. Water: Potable, not detrimental to concrete.
- D. Air Entrainment: ASTM C260.

- E. Chemical Admixture: ASTM C494, Type A - Water Reducing

## 2.04 ACCESSORIES

- A. Curing Compound: ASTM C309, Type 1; clear manufactured by Sonneborn.
- B. Liquid Surface Sealer: manufactured by Sonneborn.
- C. Air Entrainment: ASTM C260; DARAVAIR 1000 or equal manufactured by W. R. Grace.

## 2.05 CONCRETE MIX - BY PERFORMANCE CRITERIA

- A. Mix and deliver concrete in accordance with ASTM C94, Alternative No. 2.
- B. Select proportions for normal weight concrete in accordance with ACI 301 Method 2.
- C. Provide concrete to the following criteria for flat work, slabs and walls:
  - 1. Compressive Strength: 2200 psi @ 7 days.
  - 2. Compressive Strength: 3500 psi @ 28 days.
  - 3. Slump: ASTM C94.
- D. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.
- E. Calcium chloride will not be permitted.
- F. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.
- G. Add air entraining agent to normal weight concrete mix for work exposed to exterior at a rate of 5-7 percent air content.
- H. Concrete for foundations shall conform to MSHA Mix No. 2 or better.

## 2.06 SOURCE QUALITY CONTROL

- A. Provide mix design under provisions of Section 01 40 00.
- B. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of work.
- C. Tests on cement and aggregates will be performed to ensure conformance with specified requirements.
- D. Test samples in accordance with ACI 301 and as specified in section.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify base conditions under provisions of Section.
- B. Verify compacted granular base is acceptable and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.

### 3.02 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole catch basin and frames with oil to prevent bond with concrete pavement.
- C. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

### 3.03 FORMING

- A. Place and secure forms to correct location, dimension, and profile.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

### 3.04 REINFORCEMENT

- A. Place reinforcement as indicated.
- B. Interrupt reinforcement at expansion joints.
- C. Place reinforcement to achieve pavement and curb alignment as detailed.
- D. Provide doweled joints 12 inch o.c. at interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement.

### 3.05 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301. as specified in Section.
- B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- C. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- D. Place concrete to pattern indicated.

### 3.06 JOINTS

- A. Place expansion joints at 20 foot intervals. Align curb, gutter, and sidewalk joints.

- B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 3 inch for sealant placement by Section.
- C. Provide scored joints at intervals indicated on drawings at 2 inch depth.

### 3.07 FINISHING

- A. Area Paving: Wood float with light broom.
- B. Sidewalk Paving: Light broom, radius to 1/8 inch radius, and trowel joint edges.
- C. Curbs and Gutters: Light broom.
- D. Inclined Wheelchair Ramps: Herringbone V-joint
- E. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

### 3.08 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 40 00.
- B. Three concrete test cylinders will be taken for every 50 or less cu. yds. of concrete of each class placed each day. Cylinders shall be tested on 7 and 28 day intervals, the third cylinder shall be tested if a failure should occur and be utilized as a comparison.
- C. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.
- D. One slump test and air content test will be taken for each set of test cylinders taken.
- E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.
- F. Tolerance at top of curb shall not vary more than 3 inch total dimension variance within a ten (10) foot straight edge. Vertically, the total dimension variance shall not be greater than 1/8 inch in a six (6) inch curb face. Total dimension variance between spot elevations in the same plain shall not be greater than 2 inch.

### 3.09 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION

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## SECTION 31 22 13 ROUGH GRADING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Removal of topsoil and subsoil.
- B. Cutting, grading, filling and rough contouring the site.

#### 1.2 RELATED SECTIONS

- A. Section 31 10 00 - Site Clearing.
- B. Section 31 23 16 - Excavation.
- C. Section 31 23 23.13 - Backfilling.
- D. Section 31 23 16.13 - Trenching.

#### 1.3 REFERENCES

- A. ANSI/ASTM D-698 - Testing for Maximum Dry Density.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Samples: Submit 40-50 lb. sample of each type of fill to testing laboratory, in air-tight containers at least fourteen (14) days prior to start of construction.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01 78 39.
- B. Accurately record actual locations of utilities remaining, by horizontal dimensions, elevations or inverts, and slope gradients.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Topsoil: Excavated material, graded, free of roots, rocks larger than 1 inch, subsoil, debris, and large weed.
- B. Screened Topsoil: Excavated or imported material that has been processed to remove roots, rocks, debris and other deleterious material larger than 2 inch.
- C. Subsoil: Excavated material, graded, free of lumps larger than 6 inches, rocks larger than 3 inches, and debris.
- D. Granular Fill: specified in Section 31 23 23.13.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify site conditions under provisions of Section 01 31 00.
- B. Verify that survey benchmark and intended elevations for the Work are as indicated.

### 3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Identify known underground, above ground, and aerial utilities. Stake and flag locations.
- C. Notify utility company to remove and relocate utilities.
- D. Protect above and below grade utilities which are to remain.
- E. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.
- F. Protect bench marks, property corners, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.
- G. Utility notification shall be the responsibility of the Contractor to assure themselves that no hazard exists or damage will occur to utilities. It is required that the Contractor contact "Miss Utility", 72 hours prior to the start of site work at 1-800-257-7777.

### 3.3 SUBSOIL EXCAVATION

- A. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.
- B. Stockpile in area designated on site. Remove excess sub-soil not being reused, from site at no expense to the Owner.
- C. Do not excavate wet subsoil.
- D. When excavation through roots is necessary, perform work by hand and cut roots with sharp axe.

### 3.4 FILLING

- A. Fill areas to contours and elevations with unfrozen materials.
- B. Granular Fill: Place and compact materials in continuous layers not exceeding 10 inch loose lifts when compacted by heavy compaction requirement and maximum 4 inch loose lifts when compacted by hand-operated tampers or light compaction equipment, compacted to 100 percent of maximum dry density as determined by ASTM D-698.
- C. Subsoil and Topsoil Fill: Place and compact material in continuous layers not exceeding 10 inch loose lifts when compacted by heavy compaction requirement and maximum 4 inch loose lifts when compacted by hand-operated tampers or light compaction

equipment, compacted to 100 percent of maximum dry density as determined by ASTM D-698.

- D. Maintain optimum moisture content of fill materials to within  $\pm 2\%$  of the optimum moisture content to attain required compaction density.
- E. Slope grade away from building minimum 1 inch in 1 ft, for 12 foot distance unless noted otherwise.
- F. Make grade changes gradual. Blend slope into level areas.
- G. Remove surplus fill materials from site at no expense to Owner.

### 3.5 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 1/10 foot.

### 3.6 FIELD QUALITY CONTROL

- A. Tests and analysis of fill material will be performed in accordance with standard Proctor Moisture - Density Relationship Test and with Section 01400.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D1556 with Section 01400.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- D. Frequency of Tests: as specified in Section 31 23 16 - Excavation and Section 31 23 23.13 - Backfilling.

END OF SECTION

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## SECTION 31 23 16 EXCAVATION

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Excavation for building foundations.
- B. Excavation for slabs-on-grade, landscaping.

#### 1.2 RELATED SECTIONS

- A. Section 31 22 13 - Rough Grading.
- B. Section 31 23 23.13 - Backfilling.
- C. Section 31 23 16.13 - Trenching.

#### 1.3 FIELD MEASUREMENTS

- A. Verify that survey benchmark and intended elevations for the Work are as indicated.

#### 1.4 CLASSIFICATION OF EXCAVATION

- A. All excavation required shall be unclassified, that is, the bid price shall be taken to include and cover all materials required to be excavated whether wet or dry and regardless of the character of the materials.
- B. Any soil or excavation, including but not limited to rock, which is not required for the finished work, shall be removed from the site as part of the contract sum.

### PART 2 PRODUCTS

Not Used.

### PART 3 EXECUTION

#### 3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Identify known underground, above ground, and aerial utilities. Stake and flag locations.
- C. Notify utility company to remove and relocate utilities.
- D. Protect above and below grade utilities which are to remain.
- E. Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- F. Protect bench marks, existing structures, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

### 3.2 EXCAVATION

- A. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.
- B. Excavate subsoil required to accommodate building foundations, slabs-on-grade paving and site structures, and Construction operations.
- C. Machine slope banks to angle of repose or less, until shored.
- D. Excavation cut not to interfere with normal 30 degree bearing splay of foundation.
- E. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- F. Hand trim excavation. Remove loose matter.
- G. Remove lumped subsoil, boulders, and rock.
- H. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- I. Correct unauthorized excavation at no extra cost to Owner.
- J. Correct areas over-excavated by error.
- K. Stockpile excavated material in area designated on site and remove excess material not being reused, from site at no expense to Owner.

### 3.3 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 01 40 00.
- B. Provide for visual and instrument inspection of bearing surfaces.
- C. Bearing surfaces shall be tested by Dynamic Cone Penetrometer per ASTM Special Technical Publication STP-399 - Dynamic Cone for in-situ penetration testing at a minimum rate of one (1) test per ten lineal feet of spread footing and three (3) tests per column footing.

### 3.4 PROTECTION

- A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation, from freezing.

END OF SECTION

## SECTION 31 23 16.13 TRENCHING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Excavate trenches for utilities as indicated on the plans from building to municipal utilities.
- B. Compacted bedding under fill over utilities to subgrade elevations.
- C. Backfilling and compaction requirements.
- D. Compliance with utility specifications.

#### 1.2 RELATED SECTIONS

- A. Section 31 22 13 - Rough Grading.
- B. Section 31 23 16 - Excavation.
- C. Section 31 23 23.13 - Backfilling.

#### 1.3 REFERENCES

- A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ANSI/ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- C. ANSI/ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures.

#### 1.4 SUBMITTALS

- A. Submit under provision of Section 01 33 00.
- B. Samples: Submit 40-50 lb sample of each type of fill to testing laboratory, in air-tight containers at least fourteen (14) days prior to the start of construction.

#### 1.5 FIELD MEASUREMENTS

- A. Verify that survey benchmark and intended elevations for the Work are as shown on Drawings.

#### 1.6 PROTECTION

- A. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation.
- B. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

- C. Notify Architect/Engineer of unexpected subsurface conditions and discontinue work in affected area until notification to resume work.
- D. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.
- E. Grade excavation top perimeter to prevent surface water run-off into excavation.

## PART 2 PRODUCTS

### 2.1 FILL MATERIALS

- A. Types A, B, C, Subsoil and Concrete materials as specified in Section 31 23 16.13.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify fill materials to be reused, is acceptable.

### 3.2 PREPARATION

- A. Identify required lines, levels, contours and datum.
- B. Maintain and protect existing utilities remaining, which pass through work area.
- C. Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.
- E. Protect above and below grade utilities which are to remain.
- F. Cut out soft areas of subgrade not capable of insitu compaction in their natural and present state. Backfill with Type C fill as specified in Section 31 23 23.13 and compact to density equal to or greater than requirements for subsequent backfill material.

### 3.3 EXCAVATION

- A. Excavate subsoil required for utility piping to municipal utilities requirements or as detailed.
- B. Cut trenches sufficiently wide to enable installation of utilities and allow inspection. Minimum clearance shall be 6 inches on each side of pipe or conduit.
- C. Excavation shall not interfere with normal 30 degree bearing splay of foundations.
- D. Hand trim excavation. Hand trim for bell and spigot pipe joints, if required. Remove loose matter.
- E. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd, measured by volume.



- F. Correct unauthorized excavation at no cost to Owner.
- G. Correct areas over-excavated by error in accordance with Section 31 23 16 at no additional cost to the Owner.
- H. Stockpile excavated material in area designated on site and remove excess material not being re-used from site at no expense to the Owner.

### 3.4 BEDDING

- A. Support pipe or conduit during placement and compaction of bedding fill.

### 3.5 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Bedding Fill: Place and compact materials in continuous layers not exceeding 4 inches loose lifts when compacted by hand-operated or light compaction equipment.
- D. Approved Subsoil Fill: Place and compact material in continuous layers not exceeding 4 inches loose lifts when compacted by hand-operated or light compaction equipment.
- E. Employ a placement method that does not disturb or damage foundation perimeter drainage or conduit in trench.
- F. Maintain optimum moisture content of backfill materials to attain required compaction density.
- G. Remove surplus backfill materials from site at no additional cost to Owner.
- H. Leave fill material stockpile areas completely free of excess fill materials.

### 3.6 TOLERANCES

- A. Top Surface of Backfilling: Under Paved Areas Plus or minus one inch from required elevations.
- B. Top Surface of General Backfilling: Plus or minus one inch from required elevations.

### 3.7 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 40 00.
- B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D2487 and with Section 01 40 00.
- C. Compaction testing will be performed in accordance with ANSI/ASTM D1556 and ANSI/ASTM D1557 and Section 01 40 00.

- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- E. Frequency of Tests: Minimum one (1) test every 25 lineal feet of trench, each layer, or as may be determined by Owner.

### 3.8 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section.
- B. Recompect fills subjected to vehicular traffic.

### 3.9 SCHEDULE

- A. Water, Gas, and Sanitary Piping:
  - 1. Bedding Fill: Type B (Structural Fill) or as required by the local authority=s Construction Specifications and all addenda, compacted to 95 percent. Minimum depth 6 inches above top of pipe.
  - 2. Cover with Type B (Structural Fill), in 8 inch lifts, compacted to 100 percent.
- B. Power Ducts
  - 1. Bedding fill of Type C (Select Fill), in 8 inch lifts, compacted to 100 percent.
  - 2. Remaining fill of Type C (Select Fill), to subgrade elevation, compacted to 100 percent.
- C. Storm Drain
  - 1. Wherever rock is encountered, it shall be removed and replaced with a minimum 8 in. (200 mm) of select backfill to provide a constant cushion under the pipe or bell. When unsuitable foundation material is encountered, it shall be removed and replaced with selected backfill for the full width of the trench, as directed by the Engineer.
  - 2. Culverts 48 in. (1220 mm) or more in nominal horizontal diameter shall be bedded in an approved foundation shaped by means of a template which will support the pipe for at least 10 percent of its overall height.
- D. General Utility Information
  - 1. All underground utility trenches shall be backfilled as specified and shall have a warning tape at depth as detailed or as by the Owner.
  - 2. All plastic underground utilities shall in addition have a detection wire installed at trench depth indicated or as directed by the Owner.

END OF SECTION

## SECTION 31 23 23.13 BACKFILLING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Building perimeter and site structure backfilling subgrade elevations.
- B. Site filling and backfilling.
- C. Fill under slabs-on-grade and paving.
- D. Consolidation and compaction.
- E. Fill for over-excavation.

#### 1.2 RELATED SECTIONS

- A. Section 31 23 16 - Excavation.
- B. Section 31 23 16.13 - Trenching.

#### 1.3 REFERENCES

- A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ANSI/ASTM D698 - Test Methods for Moisture - Density Relations of Soils and Soil - Aggregate Mixtures.
- C. ANSI/ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Samples: Submit 40 lb. dry density sample of each type of fill to testing laboratory, in air-tight containers at least fourteen (14) days prior to the start of construction.

## PART 2 PRODUCTS

### 2.1 FILL MATERIALS

- A. Type A - Coarse Stone: No. 57 Stone Angular, washed natural stone; free of shale, clay, friable material, sand, debris; graded in accordance with ANSI/ASTM C136 within the following limits:

<u>Sieve Size</u>	<u>Percent Passing</u>
1 2 inch	100
1 inch	95 to 100
2 inch	25 to 60
No. 4	0 to 10

- B. Type B - Structural Fill: Suitable materials as outlined in the Geotechnical Report.
- C. Type C - Select Fill: MDOT Graded Aggregate Base.
- D. Subsoil: Reused, Imported, free of gravel larger than 3 inch size, and debris.
- E. Concrete: Structural concrete conforming to Section with a compressive strength of 4,000 psi.

### 2.2 ACCESSORIES

- A. Vapor Retardant: 6 mil thick, polyethylene.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify fill materials to be reused are acceptable.
- B. Verify foundation perimeter drainage installation has been inspected.
- C. Verify underground tanks are anchored to their own foundation to avoid flotation after backfilling.

### 3.2 PREPARATION

- A. Generally, compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of insitu compaction. Backfill with Type B fill and compact to density equal to or greater than requirements for subsequent backfill material.
- C. Prior to placement of aggregate base course material at paved areas, compact subsoil to 100 percent of its maximum dry density in accordance with the Geo-Technical Engineer's recommendations.

### 3.3 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Granular Fill: Place in accordance with the Geotechnical report in Section 02010.
- D. Soil Fill: Place and compact material in continuous layers not exceeding 10 inches loose depth if compacted with heavy equipment and 4 inches when compacted by hand operated or light compaction equipment.
- E. Maintain optimum moisture content of backfill materials to attain required compaction density.
- F. Backfill against supported foundation walls. Do not back-fill against unsupported foundation walls.
- G. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- H. Slope grade away from building minimum 1 unit vertical in 20 units horizontal for a minimum distance of 10 feet, unless noted otherwise.
- I. Make grade changes gradual. Blend slope into level areas.
- J. Remove surplus backfill materials from site.
- K. Leave required fill material stockpile areas completely free of excess fill materials which are to be removed from the site.

### 3.4 TOLERANCES

- A. Top Surface of Backfilling Under Paved Areas: Plus or minus one inch from required elevations.

### 3.5 FIELD QUALITY CONTROL

- A. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D2487 and with Section 01 40 0.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D1557 and with Section 01 40 00 and Section.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- D. Frequency of Tests: Provide a minimum of one test per lift for each 500 square feet of backfill or a minimum of four (4) tests per layer of fill or at Owner's requests.
- E. Proof roll compacted fill surfaces under slabs-on-grade pavers and paving.
- F. Tests within the stormwater management structure shall be performed in accordance with the Maryland 378 Specifications for ponds.

### 3.6 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section.
- B. Recompect fills subjected to vehicular traffic.

### 3.7 SCHEDULE-COMPACTION

- A. Interior Slab-On-Grade:
  - 1. Type A fill, 6 inches thick, compacted with plate compactor.
- B. Exterior Side of Foundation Walls, Retaining Walls and Over Granular Filter Material and Foundation Perimeter Drainage:
  - 1. Type A fill, to subgrade elevation, each lift, compacted to 95 percent.
- C. Fill Under Grass Areas:
  - 1. Subsoil fill, to 6 inches below finish grade, compacted to 90 percent.
- D. Fill Under Landscaped Areas:
  - 1. Subsoil fill, to 12 inches below finish grade, compacted to 90 percent.
- E. Fill Under Asphalt Concrete Paving:
  - 1. Heavy Duty Paving
    - a. 6 inches of graded aggregate base course compacted to 100% of Standard Proctor.
  - 2. Car Parking
    - a. 6 inches of graded aggregate base course compacted to 100% of Standard Proctor.
- F. Fill under Structure and Pavements, below aggregate base course and any fill required to Correct Over-excavation:
  - 1. Type B (Structural fill) fill, flush to required elevation, compacted to 100 percent at structure and 98% at common areas.
- G. Sidewalks, concrete walkways, trenches and stoops:
  - 1. 4 inches of Type C (Select fill) fill, to 4 inches below finish paving elevation, compacted to 98 percent.
- H. Trench Work (Under landscaped areas)
  - 1. Type C fill to 12 inches below finish grade, compacted to 90 percent.
- I. Trench Work (under Asphalt Concrete Paving)

1. 10 inches of Type C fill to 5 to 2 inches below finish paving elevation as scheduled, compacted to 100 percent.
- J. Manhole, inlet, underground structure bedding.
  1. Type C fill 12" deep compacted at 100 percent.
- K. Concrete Dumpster Pads and Loading Dock Drive
  1. 8 inches of Graded Aggregate Base compacted to 100 percent.
- L. Stormwater Management Structure
  1. Materials/Compaction in accordance with the Maryland 378 Specifications for ponds.

END OF SECTION

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## SECTION 31 25 00 EROSION CONTROL

### PART 1 - GENERAL

#### 1.1 REQUIREMENTS OF REGULATORY AGENCIES

##### A. Erosion and Sediment Control Plan:

1. Prior to initiating earthmoving activities, implement the approved Soil Erosion and Sediment Control Plan shown on the Contract Drawings in accordance with rules and regulations adopted by the Maryland Department of the Environment, Water Management Administration.

##### B. Fines and related costs resulting from failure to provide adequate protection against soil erosion and sediment control are the obligation of the Contractor.

1. Silt, sediment, and mud leaving the site will be construed as damage to neighboring property and evidence of negligence on the part of the Contractor.
2. Damages to neighboring property shall be rectified to the satisfaction of the neighbor and/or restitution shall be paid by the Contractor.

##### C. Conduct work in compliance with rules, regulations and requirements of the Maryland Department of the Environment, Water Management Administration and the approved contract drawings. Erosion and sediment control measures employed will be subject to approval and inspection by the Water Management Administration Inspector.

#### 1.2 SUBMITTALS

##### A. Samples: Submit samples of materials being used when requested by the Engineer including names, sources, and descriptions.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

##### A. Materials for erosion and sediment control work are as described on the Contract Drawings.

### PART 3 - EXECUTION

#### 3.1 PERFORMANCE

- A. Conduct work in compliance with the approved erosion and sediment control plan.
- B. Maintain all sediment control measures in optimum working condition throughout duration of project

END OF SECTION

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SECTION 31 37 00  
RIP RAP

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Riprap.

1.02 RELATED SECTIONS

- A. Section 31 23 23.13 – Backfill.
- B. Section 31 23 16.13 – Trenching.
- C. Section 33 42 11 – Stormwater Piping.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with Maryland Department of Transportation, State Highway Administration Standard Specifications - latest edition.
- B. Maintain one copy of each document on site for Construction and Materials.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Riprap Materials: Provide in accordance with Maryland Department of Transportation, State Highway Administration "Standard Specifications for Construction and Materials" dated January 2001, including the latest revisions.
- B. Riprap: Limestone type; broken stone irregular shaped rock; solid and nonfriable; minimum size, as indicated.
- C. Filter Cloth: Refer to Maryland State Highway Administration Specifications Section 921.09, Class SE.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not place riprap over frozen or spongy subgrade surfaces.

3.02 PLACEMENT

- A. Place geotextile fabric over substrata, lap edges and ends.
- B. Place riprap at culvert pipe ends as indicated on plans.

3.03 SCHEDULES

- A. Culvert Pipe Ends: Riprap shall not be placed until area is stabilized.

END OF SECTION

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## SECTION 32 12 00 FLEXIBLE PAVING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Asphaltic concrete paving and surface sealer; wearing binder or base course.
- B. Aggregate base course.
- C. Pavement markings.

#### 1.2 RELATED SECTIONS

- A. Section 31 23 23.13 - Backfilling.

#### 1.3 REFERENCES

- A. Maryland Dept. of Transportation State Highway Administration Standard specifications for Construction and Materials - latest edition.
- B. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI) - latest edition.
- C. MS-8 - Asphalt Paving Manual - The Asphalt Institute (AI) - latest edition.
- D. MS-19 - Basic Asphalt Emulsion Manual, The Asphalt Institute (AI) - latest edition.
- E. ASTM D946 - Penetration-Graded Asphalt Cement for Use in Pavement Construction.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Paving: Designed for buses, light duty commercial vehicles, and passenger cars.

#### 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AI Manual MS-8 and State of Maryland Highways standards.
- B. Mixing Plant: Conform to AI Manual MS-3 and State of Maryland Highways Public Work's standard.
- C. Obtain materials from same source throughout.
- D. Maintain one copy of each document on site.

#### 1.6 SUBMITTALS

- A. Submit certification in accordance with Section 01 33 00 that materials and products meet or exceed specified requirements.

## 1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable code for paving work on public property.

## 1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not place surface asphalt until base surface temperature is 40 degrees F and rising, and at least 32 degrees F and rising for placing base asphalt. Do not place pavement if surface is wet or frozen.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Asphalt Cement: In accordance with State of Maryland Highways Standards. No Bid Price adjustment for fluctuations in the price of asphalt cement will be allowed under this Contract.
- B. Aggregate for Binder Course Mix: In accordance with State of Maryland Highways standards.
- C. Aggregate for Wearing Course Mix: In accordance with State of Maryland Highways standards.
- D. Fine Aggregate: In accordance with State of Maryland Highways standards.
- E. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.

### 2.2 ACCESSORIES

- A. Tack Coat: Homogeneous, medium curing, liquid asphalt in accordance with State of Maryland Highways standards.
- B. Joint Sealer: Hot applied joint filler meeting the requirements of AASHTO and M173.
  - 1. Apply in accordance with manufacturer's recommended pouring temperature with a minimum thickness of 1/2 inch.

### 2.3 ASPHALT PAVING MIX

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Binder Course: 4.5 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2 and State of Maryland Highways standards.
- C. Wearing Course: 5 to 7 percent of asphalt cement by weight in mixture in accordance with AI MS-2 and State of Maryland Highways standards.

### 2.4 PAVEMENT MARKINGS

- A. Pavement Marking: Alkyd Resin Type, 75% solids by weight and 54% solids by volume equal to PPG's eleven (11) series. Federal Spec. (GSA-FES) TT-P-115F Type I. Colors shall be provided in white, yellow and blue.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify base conditions under provisions of Section.
- B. Verify that compacted granular base is dry and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.

#### 3.2 SUBBASE

- A. Section 31 23 23.13 - Backfilling: Type C forms the base construction for work of this Section.

#### 3.3 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with AI MS-19 and State of Maryland Highways Standards.
- B. Apply tack coat to contact surfaces of curbs, and gutters.
- C. Coat surfaces of manhole catch basin and frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

#### 3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with State of Maryland Highways Standards.
- B. Place asphalt within 24 hours of applying tack coat.
- C. Maximum compacted depth for a single course shall not exceed 4 inches.
- D. Install gutter drainage grates and frames and manhole frames in correct position and elevation.
- E. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- F. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

#### 3.5 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Install work in accordance with State of Maryland Highway Standards.
- B. Place asphalt within 24 hours of applying tack coat.

- C. For course layers greater than 4 inches, place in multiple lifts with no single lift greater than 3 inches of compacted depth.
- D. Place wearing course within 48 hours of placing and compacting base binder course.
- E. Place wearing course(s) to 1 1/2 inch to 2 inch compacted thickness.
- F. Install gutter drainage grilles and frames and manhole frames in correct position and elevation.
- G. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- H. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.
- I. All utility appurtenances, such as, but not limited to, manhole covers, cleanouts, valves, etc. shall be flush with the finished asphalt surface.

### 3.6 JOINT SEALERS

- A. Apply joint sealer in accordance with manufacturer's recommended pouring temperature at a minimum thickness of 1/2 inch.

### 3.7 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation from True Elevation: Within 1/2 inch.

### 3.8 PAVEMENT MARKINGS

- A. Lines shall be a minimum 4 inches wide applied with one coat of specified product. Colors shall be as selected by the Architect in blue, white and yellow.

### 3.9 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury for seven (7) days.

END OF SECTION



## SECTION 32 92 19 SEEDING

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Permanent seeding, mulching and fertilizer for playing fields and green areas around buildings.
- B. Maintenance

#### 1.02 RELATED SECTIONS

- A Section 32 93 00 - Landscaping.

#### 1.03 REFERENCES

- A. FS O-F-241 - Fertilizers, Mixed, Commercial.

#### 1.04 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

#### 1.05 MAINTENANCE DATA

- A. Submit under provisions of Section 01 78 39.
- B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

#### 1.06 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

#### 1.07 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.
- C. Provide soils analysis report per Article 2.03.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section.
- B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

- C. Deliver fertilized in waterproof bags showing weight, chemical analysis, and name of manufacturer.

## 1.09 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.

## 1.10 MAINTENANCE SERVICE

- A. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition and until contract completion.

## PART 2 PRODUCTS

### 2.01 SEED MIXTURE

- A. General Seed Blend
  - Tall Turf Type Fescue 85%
  - Kentucky Blue 5%
  - Perennial Rye 10%
- B. Steep Grade Blend - All slopes steeper than 2.5:1 Horizontal to Vertical:
  - Annual Rye 28%
  - Red Clover 12%
  - Switchgrass 8%
  - Deertongue 12%
  - Wild Rye 12%
  - Gama Grass 8%
  - Red Top 20%

### 2.02 ACCESSORIES

- A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
- B. Fertilizer: FS O-F-241, Type recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis.
- C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.
- D. Erosion Fabric: Jute matting, open weave.
- E. Herbicide: As approved by seeding manufacturer.
- F. Stakes: Softwood lumber, chisel pointed.
- G. String: Inorganic fiber.

### 2.03 TESTS

- A. Provide analysis of any topsoil under provisions of Section 01 40 00.

- B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- C. Submit minimum 10 oz sample of imported topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this Section.

#### 3.02 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to roller compaction.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

#### 3.03 SEEDING

- A. Apply seed at a rate of 240 lbs. per acre. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Planting Season: Sept. 15, to Oct. 15, or March 15, to June 15.
- D. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- E. Roll seeded area with roller not exceeding 112 lbs.
- F. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 in. Maintain clear of shrubs and trees.
- G. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.
- H. Hydroseeding is an approved alternate application method.

#### 3.04 SEED PROTECTION

- A. Identify seeded areas with stakes and string around area periphery. Set string height to 36 inches. Space stakes at 96 inches.

#### 3.05 MAINTENANCE

- A. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing. Maintain maintenance throughout

the construction contract.

- B. Neatly trim edges and hand clip where necessary.
- C. Immediately remove clippings after mowing and trimming.
- D. Water to prevent grass and soil from drying out.
- E. Roll surfaces to remove minor depressions or irregularities.
- F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- G. Immediately re-seed areas which show bare spots.
- H. Protect seeded areas with warning signs during maintenance period.
- I. Provide minimum one each fall, winter, and spring fertilizing utilizing products approved by the Owner and application rates as required from soil analysis.
- J. Maintain grass until substantial completion and until substantial completion and until stand of grass is full and acceptable to the Owner/Architect.

END OF SECTION

## SECTION 32 92 23 SODDING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Preparation of subsoil.
- B. Placing topsoil.
- C. Fertilizing.
- D. Sod installation.
- E. Maintenance.

#### 1.2 RELATED SECTIONS

- A Section 31 23 23.13 - Backfilling.
- B. Section 31 23 16.13 - Trenching.
- C. Section 32 92 19 - Seeding.
- D. Section 32 93 00 - Landscaping.

#### 1.4 REFERENCES

- A. ASPA (American Sod Producers Association) - Guideline Specifications to Sodding.
- B. FS O-F-241 - Fertilizers, Mixed, Commercial.

#### 1.5 DEFINITIONS

- A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

#### 1.6 MAINTENANCE DATA

- A. Submit under provisions of Section 01 78 39.
- B. Operation Data: Submit for continuing Owner maintenance.
- C. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; application frequency, and recommended coverage of fertilizer.

## 1.7 QUALITY ASSURANCE

- A. Sod: Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.
- B. Submit sod certification for grass species and location of sod source.

## 1.8 QUALIFICATIONS

- A. Sod Producer: Company specializing in sod production and harvesting with minimum five years experience, and certified by the State of Maryland.
- B. Installer: Company approved by the sod producer.

## 1.9 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.

## 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01600.
- B. Deliver sod on pallets. Protect exposed roots from dehydration.
- C. Do not deliver more sod than can be laid within 24 hours.

## 1.11 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.

## 1.12 MAINTENANCE SERVICE

- A. Furnish service and maintenance of sodded areas for three months from Date of Substantial Completion

# PART 2 PRODUCTS

## 2.1 MATERIALS

- A. Sod: ASPA Certified Approved Field grown; cultivated grass sod; with strong fibrous root system, free of stones, burned or bare spots; containing no more than 10 weeds per 1000 sq ft.
- B. Topsoil: As specified in Section 32 93 00.
- C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

## 2.3 ACCESSORIES

- A. Wood Pegs: Softwood, sufficient size and length to ensure anchorage of sod on slope.
- B. Wire Mesh: Interwoven hexagonal plastic mesh of 2 inch size.

## 2.4 HARVESTING SOD

- A. Machine cut sod and load on pallets in accordance with ASPA Guidelines.

## 2.5 TESTS

- A. Provide analysis of topsoil fill under provisions of Section 01 40 00.
- B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this section.

## 3.2 PREPARATION OF SUBSOIL

- A. Prepare sub-soil and eliminate uneven areas and low spots.
- B. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- C. Remove foreign materials and undesirable plants and their roots. Do not bury foreign material beneath areas to be sodded.
- D. Remove contaminated subsoil.
- E. Scarify sub-soil to a depth of 4 inches where topsoil is to be placed.
- F. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

## 3.3 PLACING TOPSOIL

- A. Spread topsoil to a minimum depth of 2 inches over area to be sodded.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.
- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

## 3.4 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.

- B. Apply after smooth raking of topsoil and prior to installation of sod.
- C. Apply fertilizer no more than 48 hours before laying sod.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

### 3.5 LAYING SOD

- A. Moisten prepared surface immediately prior to laying sod.
- B. Lay sod immediately after delivery to site within 24 hours after harvesting to prevent deterioration.
- C. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12 inches (300 mm) minimum. Do not stretch or overlap sod pieces.
- D. Lay smooth. Align with adjoining grass areas.
- E. Place top elevation of sod even with adjoining sidewalks.
- F. On slopes 6 inches per foot and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.
- G. Prior to placing sod, on slopes exceeding 8 inches per foot, place mesh over topsoil. Securely anchor in place with wood pegs sunk firmly into the ground.
- H. Water sodded areas immediately after installation. Saturate sod to 4 inches of soil.
- I. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities.

### 3.6 MAINTENANCE

- A. Mow grass at regular intervals to maintain at a maximum height of 2-1/2. Do not cut more than 1/3 of grass blade at any one mowing.
- B. Neatly trim edges and hand clip where necessary.
- C. Immediately remove clippings after mowing and trimming.
- D. Water to prevent grass and soil from drying out.
- E. Roll surface to remove or irregularities.
- F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.



- G. Immediately replace sod to areas which show deterioration or bare spots.
- H. Protect sodded areas with warning signs during maintenance period.
- I. Provide minimum one each fall, winter, and spring fertilizing utilizing products approved by the Owner and application rates as required from soil analysis.
- J. Maintain grass until substantial completion and until substantial completion and until stand of grass is full and acceptable to the Owner/Architect.

END OF SECTION

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## SECTION 32 93 00 LANDSCAPING

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. New trees, shrubs, and ground cover for landscaping
- B. Mulch and fertilizer.
- C. Maintenance.

#### 1.02 RELATED SECTIONS

- A. Section 02936 - Seeding.
- B. Section 02938 - Sodding.

#### 1.03 REFERENCES

- A. FS O-F-241 - Fertilizers, Mixed, Commercial.
- B. ANSI Z60.1 - Nursery Stock.

#### 1.04 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.
- B. Plants: Living trees, shrubs, and ground cover specified in this Section, and described in ANSI Z60.1.

#### 1.05 MAINTENANCE DATA

- A. Submit under provisions of Section 01 33 00.
- B. Operation Data: Submit for continuing Owner maintenance.
- C. Maintenance Data: Include cutting and trimming method; types, application frequency, and recommended coverage of fertilizer.

#### 1.06 QUALITY ASSURANCE

- A. Provide inspection and testing for verifying acceptability of plants, robustness, and life expectancy.

#### 1.07 QUALIFICATIONS

- A. Nursery: Company specializing in growing and cultivating the plants with three years documented experience.
- B. Installer: Company specializing in installing and planting the plants with three years

documented experience approved by nursery.

- C. Maintenance Services: Performed by installer.

#### 1.08 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of plants, fertilizer and herbicide mixture.
- C. Plant Materials: Free of disease or hazardous insects.

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 1.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- C. Protect plants until planted.
- D. Deliver plant life materials immediately prior to placement. Keep plants moist.

#### 1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not install plant life when ambient temperatures may drop below 35 degrees F or above 90 degrees F.
- B. Do not install plants when wind velocity exceeds 30 mph.

#### 1.11 COORDINATION

- A. Coordinate work under provisions of Section 01 31 00.

#### 1.12 WARRANTY

- A. Provide one year warranty from date of substantial completion under provisions of Section 01700 for landscape plantings.
- B. Landscape Warranty: Include coverage for one continuous growing season; replace dead or unhealthy plants.
- C. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

#### 1.13 GENERAL MAINTENANCE SERVICE

- A. Maintain landscape plant life immediately after placement until plants are well established and exhibits a vigorous growing condition. Continue maintenance until termination of warranty period.
- B. Landscape Maintenance to include:
  - 1. Cultivation and weeding plant beds and tree pits.
  - 2. Applying herbicides for weed control in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.
  - 3. Remedy damage from use of insecticides.

4. Irrigating sufficient to saturate root system.
5. Pruning, including removal of dead or broken branches, and treatment of pruned areas or other wounds.
6. Disease control.
7. Maintaining wrapping, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.

## PART 2 PRODUCTS

### 2.01 TREES, SHRUBS, AND GROUND COVER

- A. Trees, Shrubs and Ground Cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

### 2.02 SOIL MATERIALS

- A. Topsoil: Excavated from site or imported.
- B. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0.

### 2.03 SOIL AMENDMENT MATERIALS

- A. Fertilizer: FS O-F-241; as recommended; with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis.
- B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.
- C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.
- D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.
- E. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of plants.
- F. Herbicide: As recommended by Nursery.
- G. Pesticide: As recommended by Nursery.

### 2.04 MULCH MATERIALS

- A. Mulching Material: Southern pine needles, free of growth or germination inhibiting ingredients.

## 2.05 ACCESSORIES

- A. Wrapping Materials: Burlap.
- B. Stakes: Softwood lumber, pointed end.
- C. Cable, Wire, Eye Bolts and Turnbuckles: Non-corrosive, of sufficient strength to withstand wind pressure and resultant movement of plant life.
- D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.
- E. Membrane: 20 mil thick, black water permeable polyolefin fabric.
- F. Edging: Galvanized steel edging equal to Reyerson steel edging.

## 2.06 TESTS

- A. Provide analysis of any imported topsoil under provisions of Section 01400.
- B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt and organic matter; and pH value.
- C. Submit minimum 10 oz sample of topsoil proposed. Forward sample to testing laboratory in sealed containers to prevent contamination.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that prepared subsoil is ready to receive work.
- B. Saturate soil with water to test drainage.

### 3.02 PREPARATION OF SUBSOIL

- A. Prepare subsoils to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.
- C. Scarify subsoils to a depth of 3 inches where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.
- D. Dig pits and beds 6 inches larger than plant root system.

### 3.03 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after initial raking of topsoil.
- C. Mix thoroughly into upper 2 inches of topsoil.
- D. Lightly water to aid the dissipation of fertilizer.

### 3.04 PLANTING

- A. Place plants in accordance with drawings.
- B. Set plants vertical.
- C. Remove non-biodegradable root containers.
- D. Set plants in pits or beds, partly filled with prepared topsoil mixture, at a minimum depth of 6 inches under each plant. Remove or loosen burlap, ropes, and wires, from the root ball.
- E. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in 6 inches layers. Maintain plant materials in vertical position.
- F. Saturate soils with water when the pit or bed is half full of top soil and again when full.
- G. Apply mulches as detailed.

### 3.05 TREE SUPPORT

- A. Brace trees vertically with plant protector wrapped guy wires and stakes to the following:

<u>Tree Caliper</u>	<u>Tree Support Method</u>
1 inch (25 mm)	1 stake with one tie
1 - 2 inches (25 - 50 mm)	2 stakes with two ties
2 - 4 inches (50 - 100 mm)	3 guy wires with eye bolts and turn buckles
Over 4 inches (100 mm)	4 guy wires with eye bolts and turn buckles

### 3.06 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Division 1.
- B. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

### 3.07 MAINTENANCE

- A. Neatly trim plants where necessary.
- B. Immediately remove clippings after trimming.
- C. Water to prevent soil from drying out.
- D. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- E. Apply pesticides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of pesticides.

END OF SECTION

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## SECTION 33 42 11 STORMWATER PIPING

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Site storm sewerage drainage piping, fittings and accessories, and bedding.

#### 1.02 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. None.

#### 1.03 RELATED SECTIONS

- A. Section 31 23 16.13 - Trenching.
- B. Section 33 42 30 – Stormwater Manholes & Structures.
- C. Section 31 13 00 – Rigid Paving.

#### 1.04 REFERENCES

- A. ANSI/ASTM A74 - Cast Iron Soil Pipe and Fittings.
- B. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- C. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- D. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10 lbs. Hammer and 18 inch Drop.
- E. ANSI/ASTM D1556 - Test Methods for Density of the Soil by the Sand-Cone Method.
- F. ANSI/ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- G. ANSI/ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- H. ANSI/ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- I. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

J. ASTM A819 and A 760 – Aluminized Steel Pipe, Type II.

K. AASHTO M252 or M294 for Polyethylene Plastic Drain Tube or Pipe.

#### 1.05 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

#### 1.06 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide data indicating pipe, and pipe accessories.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify that products meet or exceed requirements.

#### 1.07 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 78 39.

B. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### 1.08 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section.

#### 1.09 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated.

#### 1.10 COORDINATION

A. Coordinate work.

B. Coordinate the Work with termination of storm sewer connection outside building, and

trenching.

## PART 2 PRODUCTS

### 2.01 SEWER PIPE MATERIALS

- A. Concrete Pipe ASTM C76, Class III or IV gasketed joints.
- B. Smooth Interior Corrugated Polyethylene Pipe: Conform to AASHTO M252 or M294, Type S. Pipe joints are to be (WT) watertight.
- C. Aluminized Steel Pipe, Type II: Conform to ASTM A819 and A760, gasketed joints.

### 2.02 CATCH BASINS, MANHOLES, AND MISC. STRUCTURES

- A. Refer to Maryland Dept. of Transportation, State Highway Administration Standards.

### 2.03 BEDDING AND BACKFILL MATERIALS

- A. Bedding: Fill Type B (Stone Dust) as specified in Section 31 23 23.13.
- B. Backfill: Fill Type E as specified in Section 31 23 23.13.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

### 3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

### 3.03 BEDDING

- A. Excavate pipe trench in accordance with Section for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.

- B. Place bedding material at trench bottom, level materials in continuous layers not exceeding 6 inches of compacted depth for each layer required.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

### 3.04 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM C12 and manufacturer's instructions. Seal joints watertight.
- B. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- C. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches, compact to 95 percent.
- D. Refer to Section 31 23 16.13 for trenching requirements. Do not displace or damage pipe when compacting.
- E. Refer to Section 33 42 30 for manhole requirements.
- F. Connect to building collection system.

### 3.05 INSTALLATION - CATCH BASINS, MANHOLES AND MISC. STRUCTURES

- A. Form bottoms of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe End sections.
- C. Level top surface of base pad to receive concrete shaft sections, sleeved to receive storm sewer pipe sections.
- D. Establish elevations and pipe inverts for inlets and outlets as indicated.
- E. Mount grate and frame level in grout, secured to top section to elevation indicated.

### 3.06 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 40 00.
- B. Request inspection prior to and immediately after placing aggregate cover over pipe.
- C. Compaction testing will be performed in accordance with ANSI/ASTM D1557 and

with Section 01400.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

E. Frequency of Tests: Refer to Section 31 23 23.13 Backfill, Paragraph 3.5.

### 3.07 PROTECTION

A. Protect finished Work under provisions of Section.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

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SECTION 33 42 30  
STORMWATER MANHOLES & STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Precast concrete manholes and inlets with masonry transition to lid frame, covers, anchorage and accessories or modular precast with tongue and groove joints at Contractor's option.

1.02 RELATED SECTIONS

- A. Section 31 23 16 - Excavation.
- B. Section 31 23 23.13 – Backfilling.
- C. Section 31 13 00 – Rigid Paving.

1.03 REFERENCES

- A. ANSI/ASTM C55 - Concrete Building Brick.
- B. ASTM A48 – Ductile and Cast Iron Castings.
- C. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- D. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
- E. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specification for Cold Weather Masonry Construction.
- F. Maryland State Highway Administration Standards and Specifications.
- G. ASTM D1784 – Standard Specifications for Rigid PCV Compounds.
- H. ASTM F477 – Standard Specifications for Elastomeric Seals for Joining Plastic Pipe.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate manholes locations, elevations, piping, and sizes and elevations of penetrations.
- C. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five (5) years documented experience.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Cold Weather Requirements: IMIAC - Recommended Practices and Specifications for Cold Weather Masonry Construction.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Manhole Sections: Reinforced cast-in-place concrete as specified in MSHA Section 305.
- B. Concrete Brick Units: MSHA Section 903.02.
- C. Mortar for Grout: As specified in MSHA Section 902.11.
- D. Reinforcement: MSHA Section 908.
- E. Mortar for Masonry: MSHA Section 903.06.
- F. Polyvinyl Chloride (PVC) Surface Drainage Structures: ASTM F794, F949 and F1336
- G. Grates for PVC Surface Drainage Structures: ASTM A48-83 Class 30B for cast iron or A536 Grade 70-50-70 for ductile iron. Casting shall be furnished with a black paint.
- H. Backfill and Bedding: Refer to Section 31 23 23.13 for backfilling.

### 2.02 COMPONENTS

- A. Lid and Frame: Grates and lids 12" and larger shall be designed to withstand H-20 loading. Grates and lids smaller than 12" shall be designed to withstand H10 loading.
- B. Manhole Steps: Formed galvanized steel rungs; 3/4 inch diameter. Formed integral with manhole sections. Meet MSHA Specifications.

### 2.03 CONFIGURATION

- A. Shaft Construction: Concentric with eccentric cone top section; lipped male/female dry joints; sleeve to receive pipe sections.
- B. Shape: Cylindrical.
- C. Clear Inside Dimensions: 48 inch diameter, unless otherwise noted.
- D. Design Depth: As indicated.
- E. Clear Lid Opening: As indicated.
- F. Pipe Entry: Provide openings as required.
- G. Steps: 10 inches wide, 12 inches on center vertically, set into manhole wall.



## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

### 3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections

### 3.03 PLACING MANHOLE SECTIONS

- A. Place base pad, trowel top surface level.
- B. (Precast Manhole) Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.
- C. (Cast-in-Place Manhole) Form and place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, built-in fabricated metal items.
- D. Cut and fit for pipe sleeves.
- E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
- F. Set cover frames and covers level without tipping, to correct elevations.
- G. Coordinate with other sections of work to provide correct size, shape, and location.

### 3.04 SCHEDULES

- A. Refer to Contract Plans

END OF SECTION

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## **SECTION 34 77 13X - APRON DRIVE PASSENGER BOARDING BRIDGES**

### **PART 1- GENERAL**

#### **1.1 DESCRIPTION**

This item shall consist of the following: installation of one (1) new contractor-procured passenger boarding bridge (PBB). Work will also include construction of new PBB and foundations and installation of a new Pre-Conditioned Air System.

The PBBs covered by this specification are designed to extend from the terminal departure doorway to the aircraft boarding door such that passengers can enplane and deplane during normal or emergency operations while providing an environment that is protected from hazardous and atmospheric conditions. The complete assembly is protected against inclement weather conditions, both when sealed against an aircraft and when parked with the weather door closed.

All new PBB's shall meet or exceed FAA Circular AC 150/5220-21, latest edition and be Regional Jet capable with accessories that include but are not limited to:

- £ Handrails
- £ Floor modification for RJ mating
- £ Cushion attachment to prevent any gaps between the bridge and fuselage.

The Aircraft Fleet Mix for this project shall be Airbus A319/320 series, Boeing 737-700/800 series and MD-80/88/90.

All Point of Use (POU) equipment shall be located on the underside of the passenger boarding bridges when possible. In situations where the PC Air unit prohibits the PBB from lowering to the required height to mate to an aircraft, the unit may be required to be installed on top of the PBB. No ground mounted units are permitted.

NOTE: The model numbers indicated on the Contract Documents are based on ThyssenKrupp Airport Systems models TB 37/18.5-3 equipment (or equal). However, other manufacturers' equipment that meet or exceed the fully retracted and fully extended operational limits of the ThyssenKrupp models identified will be considered. Note also that the observer is positioned with his/her back to the terminal end and facing the aircraft end of the PBB when referring to left or right.

Each PBB shall be managed as shown on the contract documents and as described below.

- a. The gate that will have a new PBB installed on a new foundation is Gate A1 and is shown on the plans and details. The contractor is responsible for constructing the new foundations, procuring and installing the new PBB's, and providing Pre-Conditioned Air System at the gate.

#### **1.2 CODES, REGULATIONS, AND REFERENCES**

PBBs shall be designed to meet U.S. Codes and Regulations that have been adopted by the passenger boarding bridge industry as described below.

**1.2.1 Structural**

- a. American Institute of Steel Construction (AISC) Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.
- b. American Welding Society (AWS) Standards.
- c. Structural Design and Corrugated Steel Panels based on Van Karmon Theory and on buckling studies by Peterson and Card.

**1.2.2 Material**

Structural Plate/Steel/Shapes:	ASTM-A36
Structural Tube:	ASTM-A500
Steel Pipe:	ASTM-A53
Steel Sheet:	ASTM-A570
Steel Plate:	ASTM-A514
Hinge Pins:	ASTM-A311 Grades 1018 & 1144
Bolts:	High Strength SAE-J429 Grades 5 & 8 or ASTM-A325 & A440

**1.2.3 Mechanical.** All mechanical components and designs shall conform to the recommendations and standards established by the Society of Automotive Engineers (SAE) and the American Society of Mechanical Engineers (ASME).

**1.2.4 Electrical.** The PBB shall be listed by ETL Testing Laboratories, an NRTL testing laboratory. The PBB shall bear the mark of an independent NRTL listing to certify conformance to UL #QGLA for Passenger Boarding Bridges.

**1.2.5 Fire Protection.** PBBs shall meet the requirements of the National Fire Protection Association (NFPA) 415, “Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways,” and NFPA 101, “Life Safety Code” latest version. All finishes, floor, roof, and wall construction, service doors and hardware will conform to NFPA-415. Evidence (test results or other means) must be provided to the RPR and ARFF Administrator proving NFPA-415-6 was satisfied.

**1.2.6 Paint.** Surface preparation and painting of the PBB shall conform to the guidelines and standards of the Structural Steel Painting Council(SSPC).

## **PART 2 – PRODUCTS**

### **2.1 DESIGN CRITERIA FOR NEW PBBS AND NEW FOUNDATIONS**

The PBB shall be designed in accordance with good engineering practices and the

standards developed and adopted by the passenger boarding bridge industry. Particular attention shall be given to keeping components simple, rugged and easily accessible for routine maintenance, including lubrication, component exchange and ease of adjustment. All access panels and openings shall be sized to accommodate the component being changed or adjusted, as well as the equipment and personnel necessary to accomplish the work.

**2.1.1 Environmental Considerations.** The PBB shall operate satisfactorily under ambient temperature conditions of -25 °F (-32 °C) to 125 °F (52 °C), with wind up to 60 mph (97 kph). All components and materials shall be individually and collectively designed or selected for long service life under such conditions.

**2.1.2 Power Requirements.** The PBB shall operate on 480/277 V.A.C., 3 phase, 60 Hz. Electrical power and separate ground (4 wire). The 480 V.A.C. shall be transformed to 120/240 VAC for lighting and controls.

### **2.1.3 Structural Loads**

a. The PBB shall support the following loads. These loads may be applied in total or in part, singularly or simultaneously. The design shall be based on the combination that imposes the most adverse loading. PBB manufacturer shall confirm that PCAir and 400Hz unit dead loads submitted by the Contractor can be supported on the new bridges. In addition to the dead loads and strain caused by movement, the entire PBB shall support:

- (1) A live load of 40 pounds per square foot (psf) (195 kg/m<sup>2</sup>)
- (2) A retracted and stowed wind load of: 25 psf (122 kg/m<sup>2</sup>) or an approximate wind velocity of 90 mph (145 kph).
- (3) An operation wind load of: 12.5 psf (61 kg/m<sup>2</sup>) or an approximate wind velocity of 60 mph (97 kph).
- (4) A roof load of 25 psf (122 kg/m<sup>2</sup>).

b. The structural design shall provide sufficient torsional rigidity to avoid excessive sway when the PBB is brought to a gradual stop.

c. All mechanisms for actuating, guiding and restraining the PBB and its components shall be designed to minimize noise and sway so that no sense of insecurity shall be apparent to passengers. No operating loads shall be transmitted to the terminal building.

### **2.1.4 Structural Support Elements (Foundation Design)**

a. Anchor Bolt Assemblies: Anchor Bolts shall be ASTM A36 or ASTM A307 material. Bolts, nuts, washers, and related components shall be hot-dipped galvanized in accordance with ASTM A 123 and ASTM A 153.

All anchor bolts shall be properly protected from bending and damage during, and after construction. The Contractor shall furnish layout templates, anchor bolts, anchor and leveling nuts, as required to complete the installation. Nuts shall meet the requirements of ASTM A 449 and shall be galvanized. In addition, after installation, tack welds shall anchor the nuts to the base. All zinc coating removed or damaged by welding or by any other reason shall be cleaned and repaired with galvanizing repair primer meeting the requirements of FS TT- P-641 G (1).

- b. The Contractor shall confirm the PBB configuration and foundation locations prior to fabricating any materials associated with the support column. Exact shaft locations and anchor bolt configuration may vary based on the actual PBB manufacturer and Model being provided. The Contractor shall provide drawings and template location for all anchor bolt locations and detailing all work required to set the anchor bolts. Any expense incurred because of any error in setting anchor bolts shall be borne by the Contractor.
- c. An approved non-shrinking, grout shall be used underneath the column baseplate and leveling-plate. Grout shall be a no-iron mix to preclude unsightly rust marks.

## 2.2 PRODUCT REQUIREMENTS

### 2.2.1 Rotunda Assembly

The Rotunda assembly is made up of a corridor, rotunda and support column. The assembly shall be designed so that no live or dead loads or vibrations are transmitted to the building.

The rotunda assembly shall be designed as the terminal end pivot for PBB's vertical and horizontal motion. As the main pivot for the PBB, the rotunda assembly shall allow the PBB to swing a total of 175°, 87.5° clockwise and 87.5° counterclockwise from the corridor centerline.

Slope, over-travel and operational swing limits shall be located on the rotunda assembly. Slope limits shall be adjustable up to 12% (6.84°) and set for an operational limit of 10% (5.71°) for both up and down slopes as needed to meet local operating conditions and requirements.

Swing sensors shall be provided at the rotunda, that sense the position of the PBB and sounds an audible alarm at the operator's control console prior to activation of the over-travel swing limit. These sensors shall be arranged to provide left and right swing limits and shall be adjustable over the full range of bridge swing. Activation of the slow-down sensor shall put the bridge in slow-down speed and provide an audible alarm as the bridge nears the swing limit. Activation of the swing limit shall stop the bridge, provide an audible and visual alarm, and allow the operator to travel only in the opposite direction.

An adjustable over-travel swing limit shall be provided. When activated, limit switch shall cut off all power preventing bridge from traveling further. A keyed maintenance override switch shall be provided on the control console.

**a. Corridor**

The corridor is the interface between the rotunda and the terminal building or fixed passageway and shall have a minimum inside clear width of 4'-4.5" and minimum clear height of 7'-6" for a minimum of 15 inches. Corridor design shall allow installation of flexible weather seals and floor threshold to the face of the building or fixed passageway section.

The design of the corridor shall allow the installation of flexible weather seals and a floor threshold to the face of the building or fixed passageway.

**b. Rotunda**

The rotunda floor shall remain stationary and level at all times and provide a smooth transition between the terminal and telescoping tunnels.

Flap-type seals provide weather protection between the rotunda and the hinged telescoping tunnel section. The rotunda shall provide a dry environment free from storm blown rain water, snow, and ice.

**c. Support Column**

The support column is the structural support for the PBB. The support column rests on a foundation that shall be supplied by the Contractor.

Anchor bolt patterns and details for the new PBB's shall be provided by the PBB's manufacturer.

Haunch supports shall be provided for supporting fixed sections, as required.

An electrical panel shall be mounted on the rotunda support column to provide incoming power and control wiring termination points from the terminal. Separate disconnect switches (circuit breakers – 65kAIC) shall be provided for the bridge (80A) and any supplied auxiliary equipment including PCA (150A).

**2.2.2 Telescoping Tunnels**

Tunnel assembly connects the rotunda assembly and the aircraft cab assembly. Telescoping tunnels are rectangular in cross section. The tunnel with the largest cross section shall be closest to the aircraft.

- a.** The exterior roof, wall, and floor panels of the telescoping tunnel sections shall be constructed from 14 gauge (0.0747") formed galvanized steel panels attached to a framework of angle and tubing. These panels are formed, welded, sealed and painted to form the tunnel enclosure allowing for a smooth exterior finish. Roof shall be flat to prevent the collection of water.
- b.** A hinged transition ramp shall accommodate the difference in elevation where telescoping tunnel sections overlap. This area shall consist of a section of floor

that is sloped with respect to the tunnel centerline and hinged transition ramp. A very shallow slope shall be provided in the transition area (approximately 3 feet measured with respect to the tunnel centerline). All hinged or elevated surfaces in walkways shall be designed to prevent tripping hazards. Handrails shall be provided on both sides of the tunnel in the ramp area.

- c. Minimum interior clear dimensions for both two-tunnel and three-tunnel PBBs shall be as follows:

Minimum Floor Width:	4'-10" (1473 mm)
Minimum Interior Height:	6'-11" (2108mm)
Minimum Inter-tunnel Ramp Width:	4'-5" (1346 mm)
Minimum Corridor Width:	4'-4 1/2" (1334 mm)

- d. The telescoping tunnels shall be equipped with an exterior electrical cable conveyance system mounted along the lower side of the PBB. This system shall be accessible to maintenance personnel for inspection or cable addition at all PBB positions and operating conditions. Access to the conveyance system shall not impede passenger traffic or PBB operation. The system shall be capable of supporting a combination of cables and hoses with a maximum weight of 14 lbs/ft (17.9 kg/m) and a maximum cross-sectional area of 12 in<sup>2</sup> (7742 mm<sup>2</sup>) consisting of two 6 in<sup>2</sup> (3871 mm<sup>2</sup>) areas. The largest tunnel shall be equipped with an aluminum wire way to continue electrical cable routing beyond the electrical cable conveyance system.
- e. The tunnels shall be equipped with a mechanical stop.
- f. A cable conveyance system shall be provided for future use, in accordance with Section 3.1.14.

### 2.2.3 Service Access

A service door, landing and stair leading to the apron area constitute the service access. The service access shall be located on the right hand side of the cab end of the PBB to provide access between the PBB and apron for authorized personnel.

- a. The service door shall be steel, wire-glass, hollow core, and shall meet or exceed the ¾-hour fire rating per ASTM E152. The minimum door is 3'-0" (914 mm) wide and 6'-8" (2032 mm) high. The door shall be equipped with heavy-duty commercial-type hardware and automatic door closure. The door shall open 90° outward onto the service stair landing. A cipher lock on the outside lever with a lever inside shall be provided. A 30" (762 mm) stainless steel kick plate shall be provided to cover the lower inside portion of the door.
- b. The service stair landing shall be parallel to the adjacent tunnel floor and shall be made of hot dipped galvanized steel, open mesh grating. The landing shall be protected on the open sides by galvanized steel handrails designed to meet the OSHA standards. A switch operated light shall be provided above the



landing.

The service stair shall be equipped with self-adjusting risers and open mesh steel treads, which shall be expanded metal with a serrated edge for a gripping surface. All steps shall have an equal rise. The tread width shall be 28" (711 mm) and the maximum tread rise shall be 9-1/2" (241 mm). The length of the stair stringers varies depending on the type of aircraft serviced. The service stair shall be equipped with handrails on each side that are designed to meet OSHA standards for handrails located at stairs. The entire service stair assembly shall be galvanized steel. The service stair shall be accessible to ramp service personnel at all operational heights and positions of the PBB.

- c. The baggage slide shall be provided as part of the bridge purchase.

#### **2.2.4 Control Station**

The control station or operator compartment shall be located at the aircraft end of the PBB to provide the operator with a control console, service utilities, and control interlocks required to accomplish PBB operation. This station shall be positioned on the left side of the cab and oriented to position the operator facing forward in full view of the aircraft during the maneuvering and docking operations. It shall provide the optimum PBB maneuvering visibility for 95% of the adult population (as defined by Henry Dreyfuss in "Human Factors in Design") without obstructing passenger traffic flow. A 10 lb ABC fire extinguisher shall be supplied and mounted in the Control Station Area in a way as to be readily accessible but not interfere with the operation of the PBB.

##### **a. Control Console**

The control console shall be located in the operator compartment and is protected from the outside environment.

##### **(1) Controls**

All PBB motion controls shall be the momentary contact type (deadman) controls. All of the motion controls shall be designed to be relative to the function of the PBB being controlled, i.e., for raise and lower functions, the "raise" push button shall be located above the "lower" push button. The control console shall include the following controls:

- (a) A three-position master key switch used to select "OFF", "OPERATE" or "AUTO" (automatic leveling). The key should be able to be removed only in the "OFF" or "AUTO" positions.
- (b) A lever arm (joystick) to control forward and reverse motions while push button controls steer right and left. As the joystick is moved progressively forward or back, PBB speed shall increase proportionally to the position of the joystick. Steering, left or right, shall be able to be accomplished at the same time as forward and reverse motions. An interlock shall prevent the PBB from being driven forward when the aircraft closure is deployed.

- (c) Push button switches for raising and lowering the cab end of the PBB.
- (d) Push button switches for cab rotation, left or right.
- (e) Push buttons for independent adjustment of the left and right side of the bellows-type aircraft closure, unless otherwise approved by the RPR.
- (f) A switch for floodlights that illuminate the apron area under the aircraft and drive column undercarriage.
- (g) A switch to change the digital position indicator from its normal vertical height index to a horizontal rotation index.
- (h) A switch to change the cab floor level adjustment from an automatic operation to a manual operation.
- (i) A relative motion push-button switch to control the cab floor level adjustment while in the manual mode.
- (j) A red illuminated emergency stop button which shuts down all PBB movement when pressed.
- (k) Lamp test button to allow function testing of all indicator lights.
- (l) Switch for cab light to illuminate the area forward of the cab door.
- (m) Horn button to alert that the bridge is about to move.
- (n) An alarm to sound if the sensors on the canopy are not touching the aircraft fuselage.

**(2) Indicators**

The control console shall have indicators that display the current PBB status. The PBB status indicators shall be as follows:

- (a) A digital position indicator to display the relative vertical position of the lift column. This indicator shall also be able to be switched to give the relative horizontal rotation of the PBB. This indicator is used to vertically and horizontally pre-position the PBB prior to the arrival of the aircraft. The horizontal rotation position indicator shall also allow the operator to accurately move the PBB to an assigned parking position in aircraft "power-out" operations.
- (b) A wheel position indicator to display wheel orientation with respect to the operator's position. The wheel position indicator

- shall maintain correct wheel orientation while the cab is being rotated.
- (c) An amber light to indicate that the auto-leveling system is energized and functioning.
  - (d) A red light and audible warning to indicate the autoleveler sustained travel timer has tripped.
  - (e) A red light to indicate that the PBB has reached the operational horizontal rotation limits. Illumination of this light shall be preceded by an audible warning.
  - (f) A visual and audible indicator that the PBB drive wheels have reached the over steer limits.
  - (g) A red light to indicate aircraft closure is deployed. The closure must be fully retracted before the PBB can be moved forward.
  - (h) A red light to indicate vertical drive column fault (for electromechanical lift).
  - (i) A green light to indicate power is on.
  - (j) Other required indicators that are not located on the control console but shall be provided include a flashing amber beacon mounted under the cab to indicate that power is on and the PBB may move at any moment; and an audible warning bell mounted on the lower wheel bogie which shall ring at 94 decibels measured 10' (3048 mm) from the PBB when the PBB is moving.
  - (k) Safety decals shall be placed on the cross tube of the lower wheel assembly. These decals shall warn against storing anything on the cross tube and the chance of getting run over when the bridge is in operation.
  - (l) External mirrors shall be placed on the PBB to aid operators during PBB movements.
  - (m) Limits shall be coordinated and verified with installed accessories to ensure that no damage will occur to the accessories or PBB.

### 2.2.5 Utilities

- a. A six pair (twelve conductor) wire outlet for the installation of telephone or intercom equipment shall be located on left side wall adjacent to the control console and on the right wall of the rotunda corridor assembly.
- b. Duplex outlets (unswitched 120 volt, single phase, 15 amp) shall be located on the side wall of the control console, on the lower portion of the drive column, and in

the rotunda corridor. An additional GFI duplex outlet shall be provided on the drive column wheel carriage cross beam where it is accessible to maintenance personnel at ground level.

- c. Provisions for hardwire emergency lighting shall be provided. Sufficient Battery powered emergency light packs shall be provided in the PBB to meet the requirements of Section 5.9 of NFPA 101, "Life Safety Code" for all possible PBB configurations.
- d. A minimum of eight spare conductors shall be provided from the rotunda to the control panel for possible future additions or changes to the controlsystem.

#### **2.2.6 Control Features and Interlocks**

- a. Mechanical interlocks shall be provided to prevent damage to control circuits or PBB components by selecting opposite motions simultaneously. For example, depressing the "up" button shall prevent depressing the "down" button.
- b. When the master key switch is in the "OFF" or "AUTO" position, the controls for horizontal and vertical movement, steering, aircraft closure and cab rotation shall be inoperative.

#### **2.2.7 Aircraft Cab**

- a. The aircraft cab with operator's station shall be designed to rotate a minimum of 125°, a minimum of 92.5° counterclockwise and 32.5° clockwise from the tunnel centerline to facilitate alignment with multiple aircraft parking configurations.
- b. The rotation speed shall be 145° per minute or 2.41° per second. Limit switches and physical stops shall control the rotation limits.
- c. The operator's station shall be located on the left-hand side of the cab and shall be protected from the outside environment as well as passenger interference. The cab shall be equipped with a forward facing control console. The console shall be located behind laminated glass windows. Operation of the PBB shall be able to be accomplished without opening the weather doors. Additional visibility shall be obtained through the vision panels in the cab side-coiling curtains and windows located in front, left and right of the operator. The front window size shall be 2'-8" x 2' (813 mm x 610 mm). The left window size shall be 11" x 30-1/2" (279 mm x 775 mm). The right window shall be 2'-8" x 6" (813 mm x 152 mm).
- d. Weather doors shall be provided adjacent to the console to seal the interior from adverse weather conditions and secure the PBB from unauthorized access when the PBB is not in use. These doors shall be swinging double doors that open inward and can be latched closed and shall be installed on the right

side of the operator control console. The minimum clear width of the door is 43" (1092 mm) and a minimum clear height of 7'-6" (2,286 mm). The double swinging doors shall be equipped with 15" W x 29" H safety windows to enhance visibility.

- e. A full width spacer (10'-2" {3099 mm}) shall be located at the aircraft end of the cab floor. The spacer material, which shall meet the fire protection specifications of NFPA-415, shall be sufficiently flexible and non-abrasive to prevent scratching or other damage to the aircraft fuselage.
  - f. The cab side coiling curtain slats shall be equipped with two (2) view panels in every other curtain slat. The view panels shall be in the low normal positions on the right side and high normal position on the left side. Windows shall be a minimum of 1-1/4" W x 12" L. Wind flaps shall be provided around top of curtains.
  - g. The side coiling curtain barrel assemblies shall be covered to protect them from the weather. Covers shall be hinged to allow easy access to curtain assemblies.
  - h. A closed-circuit television (CCTV) system shall be provided complete with a monitor housed in or near the control console. The camera shall be focused on the horizontal drive wheel bogie and service stair so that the operator has an unobstructed view when servicing all aircraft.
  - i. The outer most end of the cab shall be equipped with an articulating cab floor that automatically compensates for changes in bridge slope. The floor shall be individually actuated and independently adjustable to adapt to all aircraft doorsills. This floor must be designed to be automatic with a manual override control switch. The floor shall be capable of providing a level surface adjacent to the aircraft door sill for PBB slopes from -10% to +10%. No portion of the cab floor shall exceed 10% slope in the direction of the expected passenger traffic.
- (1) The double hinged floor shall provide a smooth transition between the level floor and the tunnel section. This transition floor shall provide a smooth platform sloped approximately in the direction of passenger traffic flow. There shall be no raised surfaces that may introduce a tripping hazard to the passengers. Adjacent surfaces shall be the same level regardless of the position of the cab floor or the PBB.
  - (2) The floor shall be provided with a Regional Jet (RJ) aircraft service adapter kit. The kit shall allow docking to the Canadair Regional Jet (CRJ), the Embraer Regional Jet (ERJ) with the plug style door, as well as the standard narrow/wide body aircraft mix. The interface between the CRJ aircraft and boarding bridge shall be a smooth transition. The top of the cab floor shall abut to the top of the CRJ aircraft step/sill walking surface. The operation

of the floor shall be mechanized. A hand ramp to cover any gaps may not be used. The bridge cab floor to aircraft interface is a critical juncture and shall not have any tripping hazards. The bridge cab floor shall be designed to provide positive protection to the CRJ door, the CRJ door retract cable, and the adjacent pivot tube. The floor shall be equipped with an angle of attack sensor that will slow and/or stop the PBB motion if collision with the aircraft is imminent. The cab floor section that interfaces with the CRJ door shall be free to tip/rotate/move upward so as to prevent serious damage to the CRJ aircraft door in case of misdock or auto-leveling failure.

- (3) The passenger boarding bridge shall be designed such that initial docking to the CRJ or ERJ aircraft is made with the full bridge moving to the aircraft to the point that the cab bumper is adjacent to the fuselage. The moving floor shall then be driven out to mate up with the CRJ door top step or to cover the gap under the ERJ TAT sensor. This design shall reduce the possibility of damage to the CRJ aircraft door or ERJ TAT sensor.
  - (4) Foldable type handrails shall be provided for use when servicing RJ aircraft with retractable air stairs.
- j. Exterior floodlights shall be provided for nighttime operation to illuminate the apron area ahead of the PBB. A floodlight shall also be provided to illuminate the drive column wheel bogey area. This light shall be located under the tunnel section.
- (1) A weatherproof fluorescent fixture shall also be provided outside the weather doors to illuminate the cab-aircraft interface.
  - (2) A junction box on the underside of the cab area with a terminal block and 120V circuit shall be provided for connection of external task lights. The junction box shall be labeled “120V-Circuit for External Task Lights.” Task lighting shall consist of two floodlight fixtures. The first shall be mounted four feet above the top of the PBB on the right side of the PBB to illuminate the apron area in the swept path of the PBB. The second floodlight fixture shall be mounted ten feet above the left side of the PBB to illuminate the apron area adjacent to the aircraft. Task lighting shall contain two LED sixty-minute rotary timers.
- k. Three-face, cab-mounted, (internally) illuminated signs shall be provided. The gate sign shall be installed on top of the cab roof of each new passenger boarding bridge. The sign shall be elevated above the top of bridge with the bottom of sign a minimum 18 inches above the canopy hardware forward of sign. The sign will be weatherproof and designate the gate number on all three sides. Each surface of the sign is to be 30” H x 42” L with 18” high white letters on a black background. The sign shall be controlled by a photocell located on the underside of the passenger boarding bridge.

- l. The passenger boarding bridge shall be capable of docking to the Canadair

Regional Jet (CRJ), the Embraer Regional Jet (ERJ) with the plug style door, as well as the standard narrow/wide body aircraft mix.

- (1) The interface between the CRJ aircraft and boarding bridge shall be a smooth transition. The top of the cab floor and the top of the CRJ aircraft step/sill shall be flush. The boarding bridge floor shall not lie atop the CRJ aircraft step/sill, but rather shall abut the aircraft walking surface. The apron drive cab floor shall be a mechanized floor and shall be designed to negotiate the sensors on ERJ and CRJ jet aircraft.
- (2) The operation of the floor shall be mechanized. A hand ramp to cover any gaps shall not be used.
- (3) The bridge cab floor shall not have any steps, ledges, gaps, or surface protrusions when docked to the specified aircraft. These may present tripping hazards at the bridge to aircraft interface and are not permitted.
- (4) The bridge cab floor shall be designed to provide positive protection to the CRJ door. The cab floor section that interfaces with the CRJ door shall be free to tip/rotate/move upward so as to prevent damage to the CRJ aircraft door in case of misdock or auto-leveling failure.
- (5) The canopy closure of the boarding bridge shall form a weather seal around the door of the aircraft specified and shall be constructed so as to clear all aircraft antennas, pitot tubes, etc. The canopy shall be designed to keep all heated probes out of the contact of passengers.

Handrails shall be provided to direct and support passengers as they enter/exit the regional jet aircraft. The handrails shall be able to support 200 lbs. loading. The handrails shall keep the passengers away from any heated probes on the regional jet aircraft. The handrails shall be affixed to the bridge and shall be easy to deploy. The handrails shall provide a full barrier system to keep passengers from exiting off of the front of the bridge at any time after the boarding bridge has been docked.

- (6) The regional aircraft cab floor shall be controlled from the bridge console. The floor shall extend and retract to accommodate the regional jet aircraft steps and sensors. The extend/retract portion of the cab floor shall use a rubberized belt mechanism to ensure smooth surfaces and excellent traction in the passenger path. The extend/retract portion of the cab floor shall be located on the left side (when facing the aircraft) of the apron drive cab floor area.
- (7) The cab floor shall be equipped with appropriate sensors to safeguard the aircraft.

#### **2.2.8 Aircraft Closure or Canopy**

The aircraft end of the cab shall be equipped with a folding bellows aircraft closure.

The closure, when fitted against the fuselage, shall surround both the open aircraft door and the doorway to protect passengers from the elements. The covering shall not absorb water, shall be highly tear resistant, and shall remain flexible from -31°F (-35°C) to 127°F (52.8°C). The aircraft closure color shall be gray.

- a. Each side of the aircraft closure shall independently seal against aircraft contours.
- b. A means of preventing excessive pressure on the aircraft shall be incorporated into the canopy operating mechanism.
- c. The contacting seal shall be a soft material to prevent scratching or damage to the aircraft skin. The seals that contact the aircraft shall be designed for easy replacement.
- d. The PBB should be programmed to sound an alarm until the sensors on the canopy have touched the aircraft, forcing the PBB operator to lower the canopy.

#### **2.2.9 Automatic Leveling**

The PBB shall be equipped with an automatic leveling system (autoleveler) which shall allow the PBB to follow changes in the aircraft elevation that occur during aircraft loading and unloading. This system shall function with equal reliability for all aircraft contours. The autoleveler shall be located on the right side of the cab and be in full view of the operator at the control console.

- a. The auto-leveler shall operate such that it is engaged when the master key switch is in the "AUTO" position.
- b. The auto-leveler circuit shall include a sustained travel timer. The timer limits autolevel operation to a time which is adjustable from 1.6 to 6 seconds. A fault condition shall be assumed if the operation exceeds the set time limit. This fault condition shall cause all motor power to be disconnected and audible and visual alarms to sound.
- c. The main auto level sensing switch shall be activated upon a 5° auto level wheel rotation.

#### **2.2.10 Drive Column**

The drive column shall provide the vertical and horizontal motion for the PBB. The drive column and control systems shall be designed for smooth, quiet operation. The vertical and horizontal movements shall be capable of being operated simultaneously.

The drive column shall be divided into two major components: Vertical Drive and Horizontal Drive.



**a. Vertical Drive – Hydraulic Lift System**

- (1) The passenger boarding bridge shall move vertically by means of two extra capacity hydraulic ram assemblies.
- (2) Each ram is independent of the other and shall be capable of supporting the passenger boarding bridge under full design load. The design shall provide 100% redundancy.
- (3) The vertical travel speed shall be a minimum of 2.5 feet per minute minimum, measured at the spacer.
- (4) Hydraulic lift cylinders with mechanical stops to prevent overtravel on the lift column shall be provided. The system shall not be damaged if the bridge is raised or lowered to the cylinder stops.
- (5) The lift cylinders are equipped with internally mounted pilot operated check valves that prevent the bridge from descending in the event of a hose break or other system failure.

**b. Horizontal Drive**

A variable speed, electro-mechanical drive system shall provide horizontal travel.

- (1) The PBB tires shall be solid rubber.
- (2) The horizontal drive system shall be driven independently by electric motors with integral brakes. A solid-state controller (VFD) shall be provided for drive wheel speed control. The drive system shall provide high efficiency, smooth performance, and good component availability. The controller shall provide a variable frequency signal to provide adjustable speeds from 0 to 90' (27.4 m) per minute. The controller shall be capable of being adjusted to provide optimum responsiveness to the horizontal controls and shall provide built in diagnostics to assist with trouble shooting.
- (3) A steer angle of 180° shall be possible. Steering speed shall be adjustable from 9°/sec minimum to 14°/sec maximum.
- (4) A regenerative braking system shall allow the PBB to come to smooth controlled stops. Integral spring-applied electrically-released brakes shall be provided with each drive motor to lock the PBB in place when electrical power is disconnected. This shall also occur when the joystick is in the neutral position.
- (5) The horizontal drive motors shall be equipped with manual brake releases allowing the PBB to be towed in the event of power failure. Tow lugs shall be a component of the lower wheel frame.

### **2.2.11 Interior**

The interior finish of the PBB shall be designed to be durable and easy to clean. The materials shall be time proven to withstand the environmental exposure of airport traffic. All interior finishes shall be Class A rated and approved by the RPR.

- a. The ceiling shall be continuous coil coat painted galvanized sheets or aluminum plank.
- b. Tunnel and rotunda interior lighting shall be provided by F32 SPX T8, Bi-Pin, High Output, Energy Saving, Cool White, Fluorescent Light Fixtures (or equivalent LED Light Fixtures) that are powered by instant start electronic ballast's that provide a 1.0 ballast factor. The light fixtures shall be located between 6' and 12' on center, be recessed or troffered, and blend with the ceiling design. Other lighting systems would be acceptable, but shall provide an average light intensity at the floor shall be 18' candles (194 lux). Please note that lighting intensity levels vary significantly with changes in interior color designs. The measurements noted above are based on an interior design that incorporates white wallboard with light colored carpeting and white ceiling.

Sensors shall be located in the rotunda, be flush mounted, and on the wall near the service door at the aircraft end of the PBB. These switches shall control interior tunnel, bubble, and rotunda lights and the weatherproof florescent cab floodlight mounted outside the cab weather door.

- c. Aluminum corner molding shall be used to cover the ends of the ceiling panels and the top edge of the wall panels and shall be black to match the interior light fixtures.
- d. Insulation in the ceiling shall be 1" (25.4 mm) thick, black fabric faced fire resistant fiberglass insulation. Insulation shall be provided full coverage and shall fit tightly against light fixtures and installed above the light fixtures.
- e. The subfloor shall be galvanized/galvanealed smooth steel or 3/4" (19 mm) marine grade plywood.
- f. Ribbed rubber 3/16" (76 mm) thick shall be applied to the floor from the aircraft end of the PBB to the terminal side of the service door.
- g. PBB interior floor covering, other than covered in paragraph f above, will be carpet meeting the properties identified below:
  - (1) Product: Obtain carpet products indicated below from the Nation Joint Powers Alliance (NJPA) Schedule to comply with Owner's procurement requirements.
  - (2) Product Construction: Tufted Textured Loop

- (3) Style: blue or gray color, no pattern, uniform pile height
  - (4) Yarn System: Type 6,6 Nylon DYE
  - (5) Method: 100% Solution Dye
  - (6) Tufted Yarn Weight: 20 oz/yd<sup>2</sup> min.
  - (7) Machine Gauge: 1/12 – 1/8 in
  - (8) Stitches: 10.50 – 10.80/in
  - (9) Backing System: vinyl
  - (10) Size: 24" x 24" or 18" x 18"
  - (11) Applied Soil-Resistance Treatment
  - (12) Applied Antimicrobial Treatment
  - (13) Performance Characteristics: As follows:
    - (a) Radiant Panel: (ASTM E-648) Class 1
    - (b) Smoke Density: (ASTM E-662)
    - (c) Lightfastness: (AATCC 16-E), 4.0 @ 60 AFU's Static: (AATCC-134) < 3.0 KV
    - (d) Dimensional Stability: AACHEN Din 54318 < .10%
  - (14) Installation: Align centerline of initial run of carpet tile with centerline of PBB tunnel sections throughout length of PBB.
  - (15) New aluminum carpet molding shall be supplied with the PBB for the junctions between the tunnel and the cab bubble.
- h.** The tunnel wall treatment shall consist of floor to ceiling high pressure laminate phenolic and melamine plastic panels or coil coat painted galvanealed panels with insulation backing. The panels shall be approximately 4' (1219 mm) on center and shall be supported by clear anodized aluminum trim with a black accent strip. The design allows each panel to be removed individually. The color shall be white.

Insulation in the walls shall be 1" (25.4 mm) thick.

The walls of the rotunda pivoting section shall be developed using a series of 2-1/2" (63.5 mm) wide formed galvanized steel slats that shall be connected together to develop a coiling curtain assembly.

Wall treatments in the cab pivoting section shall be galvanized steel slats. Every other slat in the cab side coiling curtain shall be equipped with a 1- 1/2" (38mm) wide x 12" (305 mm) high wire glass vision panel to enhance operator visibility.

## **2.2.12 Interior Finishes**

- a. The coating system shall be specifically designed to provide long-term protection from the harmful effects of corrosion on passenger boarding bridges.
- b. A prime coat of Epoxy followed by a topcoat of Polyurethane for a combined average dry film thickness of 7 mils (175 microns).
- c. A topcoat of Polyurethane that is available in a wide variety of standard colors. Custom colors are also available per contractual agreement.
- d. Exceptional performance in all environments.
- e. Normal life expectancy is 10-15 years with proper maintenance, which consists of monthly inspection and repair of scratches, broken film, or delamination. Semi-annual power washing is also recommended.
- f. These coatings are environmentally friendly due to very low VOC (Volatile Organic Compounds) in the primer and the topcoat.
- g. Interior Coating Surfaces (or approved equal process)

**(1) Surface preparation:**

- (a) Contaminants shall be removed from the surface in accordance with SSPC SP-1 and appropriate SSPC commentaries.
- (b) The surface shall be mechanically cleaned in accordance with SSPC SP-3 to remove loose scale and contaminants from the surface where required.
- (c) The cab surface shall be dry abrasive blast cleaned in accordance with SSPC SP-6 to obtain a 1-3 mil profile.

**(2) Primer:**

One coat of Sherwin-Williams High Build “Chromate Free” Epoxy Primer E65AC8/E65RC5 or equivalent shall be applied. The dry film thickness shall be 2-10 mils.

**(3) Finish Coat:**

Sherwin-Williams high solids Polane H Polyurethane (or equivalent) shall be applied. The dry film thickness shall be 2-3 mils. The color shall match the wallboard color unless otherwise specified.  
The total dry film thickness shall be 4-10 mils.

**h. Interior Surfaces Not Exposed to Passengers (or approved equal process)**

**(1) Surface preparation:**

- (a) Contaminants shall be removed from the surface in accordance with SSPC SP-1 and appropriate SSPC commentaries.

(b) The surface shall be mechanically cleaned in accordance with SSPC SP-3 to remove loose scale and contaminants from the surface where required.

(2) **Primer:**

One coat of Sherwin-Williams High Build “Chromate Free” Kem Aqua 70P (Grey E61A570) primer or equivalent shall be applied. The dry film thickness shall be 1.1 mils (27 microns).

i. **Small Miscellaneous Assemblies (or approved equal process)**

(1) **Surface preparation:**

The surface shall be dry abrasive blast cleaned in accordance with SSPC SP-6 to obtain a 0.5-1.5 mil profile.

(2) **Finish Coat:**

One coat of Morton Int. Corvel Zinc Rich Gray Epoxy Powder #13-7004 shall be applied and heated to 350°F for 20 minutes. The finished coating thickness shall be 2-5 mils.

2.2.13 **Exterior Finishes (or approved equal process)**

a. **Surface Preparation:**

(1) Contaminants shall be removed from the surface in accordance with SSPC SP-1 (Solvent Wipe) requirements and commentaries.

(2) The surface shall then be dry abrasive blast cleaned in accordance with SSPC SP-6 (Commercial Blast Cleaning) requirement to obtain a 1-3 mil profile.

b. **Primer:**

One coat of Sherwin-Williams High Build Epoxy Chromate Free Primer E65 AC8E65RC5 shall be applied over the prepared surface to a dry film thickness shall be 3-17 mils (75-425 microns).

c. **Finish Coat:**

One finish coat of Sherwin-Williams polane (aliphatic) high solids, catalyzed, pigmented Polyurethane, shall be applied over the primer coat at a dry film thickness shall be 2-3 mils (50-75 microns). The color shall be white.

The total exterior finish shall provide a minimum dry film thickness shall be 6-7 mils (150-175 microns).

2.2.14 **Fire Protection**

The passenger boarding bridge shall meet the requirements of the latest version of the National Fire Protection Agency (NFPA) "Airport Terminal Buildings, Fueling Ramp Drainage and Loading Walkways", NFPA-415 and NFPA 101, “Life Safety Code” latest version.

a. The PBB shall provide a fire rated enclosure designed to provide safe means of

egress from the aircraft for a period of 5 minutes under fire exposure conditions equivalent to a free-burning jet fuel spill fire.

- b. During a ramp fire emergency, walkway interiors shall have a positive air pressure delivered from a source that shall remain uncontaminated (normally provided via the airport terminal). Any source of negative air pressure in the PBB shall be automatically shut down in the event of a fire emergency.
- c. Fire Protective Coatings shall be placed on the fixed and rotating cab floors only.

**(1) Surface Preparation:**

- a. Cab floors must be primed per exterior coating application procedures.
  - b. Surface must be dry prior to coating application.
  - c. Coating Description
  - d. Fire Protective Epoxy Coating - Thermo Lag 220 or equal
  - e. Allow to dry per manufacturer's instructions prior to topcoat application.
  - f. Apply to a total dry film thickness of 9-10 mils (225-250 microns).
- d. Fire Protection Test Results stating the PBB meet NFPA 415 must be submitted to the RPR for approval by ARFF Administrator.
  - e. Any PBB being refurbished must be brought up to current code to the extent possible. A materials list and data sheets stating that materials meet and do not meet the current NFPA 415 must be submitted to the ARFF Administrator for prior approval.

**2.2.15 Fall Protection**

Bridge roof access ladders shall be installed from the stair landing up to the top of cab. Bridge roof safety railings are required for bridges where routine maintenance is expected on the roof.

**PART 3-EXECUTION**

**3.1 GENERAL REQUIREMENTS FOR ALL PBBS WHETHER NEW, REINSTALLED, OR RENOVATED.** Existing PBBs shall be inspected to determine which modifications are required and which are already in place. Contractor shall have responsibility to confirm conditions of bridge prior to removal if bridge is to be reinstalled. Confirmation shall include the condition of the fire retardant material connecting the bridge to the terminal (will be replaced as part of installation), identification of the parameters in the Pro Logic Cabinet (PLC), and identification of the settings for recalibration of the potentiometers after the bridge has been reinstalled per the manufacturers requirements. Pre and Post placement operational checks shall be conducted and documented by the Contractor and the RPR. These

checks should test the total functionality of the bridge to document and all existing problems prior to the Contractor performing the work.

- 3.1.1 Wheel bumpers are required. Electrically activated safety hoop required.
- 3.1.2 The support column is the structural support for the PBB and each is custom made by the manufacturer to meet specific site conditions. There is limited adjustment for height once the column is built. Therefore, it is important that the vertical dimension (from the passenger service level finished floor to the top of concrete of the PBB foundation) and the horizontal dimension (from the service level face of the building to the center of the anchor bolt pattern) be accurately determined and transmitted to the PBB manufacturer by the contractor at least 15 days prior to the requested ship date.
- 3.1.3 The anchor bolt pattern and details for the new or existing PBB foundation shall be provided by the PBB's manufacturer. Contractor shall modify the existing foundation as needed to match the bolt pattern provided by the manufacturer.
- 3.1.4 New foundations shall be provided in accordance with the details in accordance with paragraph 2.1.4. **Contractor shall have responsibility for foundation adjustments if bridge manufacturer is substituted.**
- 3.1.5 Locks shall be provided and installed by the contractor on the door to the outside apron and shall meet the requirements specified in paragraph 2.2.3a.
- 3.1.6 PBB signage is required and shall meet the requirements specified in paragraph 2.2.7k. The Contractor shall be responsible for providing signage that is visible from the taxi lanes/taxiways that will pass the final Use and Occupancy inspection.
- 3.1.7 Task lighting is required and shall meet the requirements specified in paragraph 2.2.7j(2).
- 3.1.8 A flashing beacon and audible alarm mounted under the cab is required and shall meet the requirements specified in paragraph 2.2.4a (2) (j.)
- 3.1.9 A GFI duplex outlet is required on the drive column wheel carriage. Refer to paragraph 2.2.5b for additional information.
- 3.1.10 Spare conductors are required in conduit from the rotunda to the control panel. Refer to paragraph 2.2.5d for additional information.
- 3.1.11 An electrical disconnect panel, mounted on the rotunda support column is required. Refer to paragraph 2.2.1c for additional information.
- 3.1.12 Emergency Lighting is required and shall meet the requirements specified in paragraph 2.2.5c.
- 3.1.13 Provisions for telephone or intercom equipment are required and shall meet the requirements specified in paragraph 2.2.5a.

**3.1.14 PC Air.** Where indicated on the plans, the new PBB shall be provided with a cable conveyance of sufficient capacity to accommodate PC Air unit for the design aircraft fleet mix at the gate for which the PBB is intended. At minimum, provide trolley cable conveyance system, with length to cover the movable sections of the PBB for routing power to the PC Air unit. Regardless of whether a unit will be installed as part of this project, the Contractor is required to provide the dead loads and the size of the unit (as provided in the Contract Drawings) to the PBB manufacturer for inclusion in the structural design. Contractor shall provide all PC Air accessories including but not limited to hoses and hose storage devices.

**3.1.15 Aircraft Cab.** The PBB shall be provided with the capability to adjust its alignment to increase its flexibility to minimize the time required to service multiple aircraft configurations as specified in paragraph 2.2.7a.

### **3.2 CONSTRUCTION METHODS**

**3.2.1 General.** The Contractor shall install the Passenger Boarding Bridges at the locations indicated in the Contract Drawings.

**3.2.2 Transport and Deliveries.** Delivery of new Passenger Boarding Bridges shall be coordinated with Airport Operations and occur at AOA Manual Gate 130. Contractor will be required to provide security in compliance with the security requirements at Gate 30 when deliveries or transport of the PBBs are scheduled.

**3.2.3 Foundations.** The Contractor shall be required to install new or reinstall existing Passenger Boarding Bridges on existing foundations. Any modifications to the foundations will need to be designed, signed and sealed by a PE registered in the State of Maryland and submitted to RPR for information and record prior to the installation.

**3.2.4 Utilities.** The Contractor shall be responsible for all interface connections between the PBB and the building systems. During installation, the contractor shall coordinate with Airport Maintenance regarding assembly and connection of building systems with the PBB.

**3.2.5 Safety and Weathersealing.** Prior to installation of the PBB, the Contractor shall submit to the RPR a plan for temporarily covering the opening required by the PBB installation. The covering shall be weathertight to prevent any penetration of water into the building as a result of the installation of the PBB.

**3.2.6 Testing.** After installation of a Passenger Boarding Bridge, the Contractor and a Manufacturer Representative of the Passenger Boarding Bridge shall test the PBB according to the Specifications and the satisfaction of the RPR. The operation of each PBB shall undergo an aircraft test park for the most demanding aircraft docking procedures to ensure proper mating of the PBB to the aircraft. Temporary tape shall be used for the stop bar and lead-in line for the aircraft test park. Following a successful test part, the final pavement marking for the aircraft may be placed. If any problems are encountered with regards to the Passenger Boarding Bridge the Contractor shall correct at his expense and to the RPR's satisfaction and re-tests.



### 3.3 MANUALS AND TRAINING

**3.3.1** Operation and Maintenance manuals shall follow the intent of the Air Transport Association (ATA) Specification 101 and shall include preventative maintenance requirements and problem solving procedures.

**3.3.2** Operation and maintenance manuals shall be provided to the RPR by the Contractor:

- a. One Operation and Maintenance Manual.

**3.3.3** PBB operator training shall be provided, by PBB type, at scheduled times during the installation. The training schedule shall be set by the Owner for uninterrupted four-hour blocks per PBB type between 8:00 a.m. and 5:00 p.m. during the standard workweek. Training shall be provided for two airlines.

**3.3.4 Airport Submission Data.**

**a. PBB Information to Document.** All PBB installation or modification work shall require the submission by the Contractor of relevant data to the RPR for the updating of the Airport Maintenance records. This includes:

- (1) Manufacturer
- (2) Model Number
- (3) Capacity Number
- (4) Serial Number
- (5) Rotunda Elevation, surveyed in feet
- (6) Year Purchased
- (7) Cab Floor Elevation, surveyed in feet
- (8) Ramp Elevation at Stop Bars, surveyed in feet
- (9) Operational Ranges including, but not limited to, height and swing
- (10) Aircraft Fleet Mix for which stop bar markings are provided in descending order of size with length taking priority over wingspan
- (11) Accessories including, but not limited to, PC Air, 400Hz, Regional Jet Support, slides
- (12) Photos of interior and exterior
- (13) Photos of stop bar markings and lead in lines
- (14) Photo of the Serial Number Plat
- (15) Gate restrictions and/or rules

This information shall be required to be submitted following installation and initial testing, and prior to final commissioning of the PBB.

**b. Photographic Documentation Procedure.** When taking photographs to be stored, the following instructions should be followed.

- (1) Set Camera Aspect Ratio to 4:3
- (2) Set Megapixel setting to no greater than 2 Megapixels (approximately 1632px W x 1224px H)
- (3) Photos should ALWAYS be taken holding the camera horizontally
- (4) The photo needs to be saved with a descriptive name. The following is a standard approach for a descriptive file name for each photo:
  - (a) Date of Photo - YYYY\_MM\_DD
    - i. for example 2019\_01\_06
  - (b) Feature
    - i. Gate A1
    - ii. Stop Lines A1
  - (c) Photo number – sequence starting with 1.
  - (d) Example  
2019\_01\_06 Gate A1 Photo 01  
2019\_01\_06 Gate A1 Photo 02

### 3.4 WARRANTY

**3.4.1** The Contractor shall warrant that the PBBs and all components and accessories comply with the requirements of the contract documents, including approved drawings and this specification. The PBB shall perform to the design function for a minimum period of two (2) years from the date of final acceptance of the PBB by the Owner, unless otherwise indicated. Failures caused by normal wear and tear, acts of God, and modifications by the Owner, which have not been approved by the manufacturer, will be excluded from the coverage in this section.

**3.4.1.1** Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

- a. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
- b. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
- c. Warranty Period: 10 years from date of Substantial Completion.

**3.4.1.2** Special Warranty on Paint Finishes: Manufacturer agrees to repair finish or replace sheet metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

- a. Exposed Panel Finish: Deterioration includes, but is not limited to, the

following:

- (1) Color fading more than 5 Hunter units when tested according to ASTM D 2244.
- (2) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
- (3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.

**b.** Finish Warranty Period: 10 years from date of Substantial Completion.

- 3.4.2** The Contractor shall warrant that the PBBs and all their components are new and manufactured using new materials, are of good quality, are suitable use on aircraft, and are free and clear from liens, encumbrances and title defects.
- 3.4.3** The Contractor (and/or the manufacturer of the PBB, as applicable) further agrees to repair or replace any warranty defect, including both parts and labor, at his expense, within twenty-four (24) hours of notification from the Owner.
- 3.4.4** The Contractor (and/or the manufacturer of the PBB, as applicable) further agrees to repair or replace (parts and labor), at his expense, within twenty-four (24) hours, any defect which constitutes a breach of warranty, provided the Contractor is notified of such defect within twelve (12) months following the date of formal written Final Acceptance by the Owner.
- 3.4.5** The Contractor (and/or the manufacturer of the PBB, as applicable) shall provide the contact names and numbers necessary to report and address problems encountered during the warranty periods.
- 3.4.6** Upon Owner's submission of a claim as provided above and following its substantiation, Contractor (and/or the manufacturer of the PBB, as applicable) shall at its option either (1) repair or replace its product or work at the final delivery point or (2) refund an equitable portion of the purchase price.
- 3.4.7** Failure caused by: (a) Owner's abuse (b) acts of God, which shall include but not be limited to hurricanes, earthquakes, and natural disasters are specifically excluded from the coverage of this section.

#### **PART 4- MEASUREMENT AND BASIS OF PAYMENT**

**4.1** No separate measurement or payment will be made for any work included under this Section. The cost of the work described under this Section shall be included in the respective Lump Sum Alternate bids.

Costs include all labor, materials, services, equipment, and incidentals necessary to complete the work in every respect.

**END OF ITEM 34 77 13X**

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