

March 2019

Project No. 163078

PROJECT MANUAL

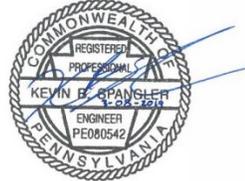
Snow Removal Equipment (SRE) Building Project

at

Erie International Airport Tom Ridge Field Erie, Pennsylvania

Prepared for

Erie Regional Airport Authority
Erie International Airport
Tom Ridge Field
4411 West 12th Street
Erie, PA 16505-0393



Prepared by

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INVITATION TO BID
ERIE INTERNATIONAL AIRPORT, TOM RIDGE FIELD
ERIE, PENNSYLVANIA

SEALED BIDS for the **SNOW REMOVAL EQUIPMENT (SRE) BUILDING PROJECT** at the Erie International Airport, Tom Ridge Field will be received at the Erie Regional Airport Authority's (ERAA) office at the Airport's Terminal Building, 4411 West 12th Street, Erie, PA 16505, until **11:00 AM, Wednesday, April 17, 2019** and immediately thereafter will be publicly opened and read aloud at the ERAA's office in the Airport's Terminal Building in the back of the ERI Cafe. The ERAA is not responsible for late mail or late deliveries. Bids submitted after the bid closing time shall not be accepted and will be returned unopened. All bids shall be received as hard copy in sealed envelopes that are marked as: **ERAA, ATTN: KIM SCHARRER, BID FOR SNOW REMOVAL EQUIPMENT (SRE) BUILDING PROJECT, 4411 WEST 12TH STREET, ERIE, PA 16505.** Note that NO facsimile, electronic or other form of response is acceptable to ERAA. Bids are to include the furnishing of all material and performance of labor as required by the Contract Documents, all in accordance with the Instructions to Bidders. No Bid or any portion thereof may be withdrawn after the date and time specified above for the receipt of bids and during the ensuing thirty (30) days thereafter.

As of March 11, 2019, the Contract Documents may be obtained by downloading and printing them from the ERAA website, under "Business Opportunities" at www.erieairport.org. **Bidders must register their intent to bid by filing their name, address, telephone number and email address with ERAA, c/o Kim Scharrer, 4411 W. 12th Street, Erie, PA, 16505, 814-833-4258, kscharrer@erieairport.org.** Bidders are responsible for obtaining Addenda. Additionally, any Addenda will be posted under "Business Opportunities" at www.erieairport.org.

For questions in regard to this Advertisement, contact Kim Scharrer, 814-833-4258, or kscharrer@erieairport.org. Any questions for requests for interpretation of the Contract Documents shall be made pursuant to Section 6 of the Instructions to Bidders, entitled "Changes and Addenda to Project Documents," contained in the Contract Documents.

A pre-bid meeting will be held at 11:00 AM, Wednesday, March 20, 2019 at the Erie International Airport Terminal Building.

Bids must be submitted on the prescribed forms furnished with the Bidding Documents. Each bid must be accompanied by a Bid Security in the form of a certified check, cashier's check, or original corporate surety Bid Bond with original power of attorney, in the amount of ten percent (10%) of the Base Bid, made in favor of "The Erie Regional Airport Authority". No Bid will be considered unless it is so guaranteed. Facsimiles and copies will not be accepted, and will provide cause for the Bid to be rejected.

The attention of Bidders is called to the Federal, State and County equal opportunity requirements, which are applicable under this Contract. All bids shall be submitted in accordance with these requirements.

The ERAA, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business

INSTRUCTION TO BIDDERS

1. SCOPE OF WORK

Bidders are invited to submit proposals for furnishing all Work shown as described in the Specifications for the following project:

**Erie International Airport
Tom Ridge Field
Snow Removal Equipment (SRE) Building Project**

This project consists of the construction of a Snow Removal Equipment (SRE) Building of approximately 13,200 sf within the airside operations area near the existing maintenance building and sand storage building, west of Taxiway B located in the Erie International Airport, Tom Ridge Field. The building includes 9 total bays used to house snow removal equipment. Additional site improvements include grading, site utilities, access road paving, stormwater management and erosion and sedimentation control measures. This project is a multi-prime project consisting of the following four contracts: General/Site, Plumbing, Mechanical (HVAC), and Electrical Contracts.

2. BIDDER'S RESPONSIBILITY

Each bidder shall familiarize him/herself with all of the attached forms, advertisement, instructions, Specifications, Bonds and Agreement, as he/she shall be held responsible to fully comply therewith.

The bidder is also required to carefully examine the Site of the Project, and it shall be assumed that he has satisfied himself as to the conditions to be encountered, the character, quality and quantities of Work to be performed and materials to be furnished, and the requirements of the Contract and Specifications. No allowance or concession shall be made for lack of such information on the part of the Contractor.

Any questions regarding the contract documents should be emailed no later than 4:00 PM, on Wednesday, April 3, 2019 to Kim Scharrer, ERAA, at kscharrer@erieairport.org.

3. SPECIFICATIONS

a. The Work shall be in strict accordance with the Specifications which are designated as follows:

**Erie International Airport
Tom Ridge Field
Snow Removal Equipment (SRE) Building Project**

- b. Bidders may obtain copies of the Contract Documents by downloading and printing them from the ERAA website, under "Business Opportunities" at www.erieairport.org. **Bidders must register their intent to bid by filing their name, address, telephone number and email address with ERAA, c/o Kim Scharrer, 4411 W. 12th Street, Erie, PA, 16505, 814-833-4258, kscharrer@erieairport.org.**

4. BID AND CONTRACTS

Bids must be sealed and addressed to:

Erie Regional Airport Authority
Erie International Airport
ATTN: Kim Scharrer
4411 West 12th Street
Erie, PA 16505

The sealed envelope shall be marked:

**ERAA, ATTN: KIM SCHARRER
BID FOR SNOW REMOVAL EQUIPMENT (SRE) BUILDING PROJECT
4411 WEST 12TH STREET
ERIE, PA 16505**

Each bid must be submitted on the forms furnished to the bidders. Bids submitted after the time specified for the receipt of bids will not be accepted and will be returned unopened. Bid documents must include those forms listed under Item 16 of the Instructions to Bidders.

The successful bidder shall be required to execute the Contract for construction and return the Contract accompanied by the Performance and Payment Bonds and Insurance Certificates herein described, within seven (7) business days after the documents are presented to him.

Erasures or other changes in the bid must be explained or noted over the signature of the bidder.

Bids may be withdrawn on written telegraphic requests received from the bidder prior to the time fixed for opening. A bidder may also withdraw his bid, providing he does so according to Pennsylvania Law.

5. BID GUARANTY

A bid security in an amount equal to at least **ten percent (10%)** of the total bid shall be submitted with each bid. This shall be in the form of a certified check, cashiers check or bid bond with good and sufficient surety. The payee in any instance shall be:

ERIE REGIONAL AIRPORT AUTHORITY

Should any surety upon any bonds become unsatisfactory to the Owner, or if for any reason any bond shall cease to be adequate security to the Owner, the Contractor shall within five (5) days after notice from the Owner to do so, furnish such additional bonds as may be required from time to time to protect the interest of the Owner and of persons, firms, or corporations supplying labor, material, equipment or services in the prosecution of the Work contemplated by the Contract. The additional bonds required shall be with other sureties as may be satisfactory to the Owner. The premiums on such additional bonds shall be paid by the Contractor. No further payments shall be deemed due, nor shall further payments be made until the required additional bonds have been furnished by the Contractor and approved by the Owner.

6. ALTERNATE BIDS AND ADDENDA

Alternate bids, except as noted herein shall not be considered. No oral interpretations shall be made to any bidder as to the meaning of the Contract Documents. Every request for such an interpretation shall be made in writing to ERAA, ATTN: Kim Scharrer. Interpretations shall be made to all bidders in the form of an addendum to the Contract Documents. All addenda shall be emailed to each bidder, but it shall be the bidder's responsibility to make inquiry as to addenda issued. All such addenda shall become part of the Contract and all bidders shall be bound by such addenda, whether or not received by the bidder. Oral interpretations or clarifications shall be without legal effect.

7. INVESTIGATION OF CONDITIONS AND ERRORS IN BID

It is required that each bidder visit the Site and acquaint himself with all available information concerning the condition of the Site, the availability of labor, and the local conditions having a bearing on the transporting, handling, and storing of materials and equipment. All bidders or their authorized agents are expected to examine the Drawings, Specifications, schedules and all other instructions pertaining to the Work which are supplied with this Project. Failure of the bidder to acquaint him/herself with all available information concerning the existing conditions shall not relieve the successful bidder of the responsibility for estimating the difficulties and costs of successfully performing the Work as required, and he/she cannot secure relief on the pleas of error in his/her bid.

The ERIE REGIONAL AIRPORT AUTHORITY, hereinafter referred to as the Owner and/or Obligees reserves the right to waive minor irregularities or minor errors in any proposal if it appears to the Owner that such irregularities or errors, so waived, can and must be corrected on the proposal in which they occur prior to the execution of the Contract, which may be awarded thereon.

8. METHOD OF AWARD OR REJECTION OF BIDS

The Bidder shall refer to Section 30 of the General Provisions as well as the Basis of Award of these bid documents for methods of award and execution of the Contract.

9. TIME OF PERFORMANCE

Work shall commence within seven (7) business days after the date of "Notice to Proceed" and the Contractor shall fully complete all Work within the time stated and under the conditions enumerated in the Agreement.

10. FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT

All Contractors shall comply with the Federal Occupational Safety and Health Act of 1970.

The Contractor and all Subcontractors pursuant to the Contract shall at all times comply with all applicable Federal, State, and local laws, provisions, and policies governing Safety and Health, including the Federal Construction Safety Act (Public Law 91-54) Federal Register Chapter XVII, Part 1926 of Title 29 Code of Federal Regulations, Occupational Safety and Health Regulations for Construction, and all subsequent revisions updating these regulations.

The Contractor and all Subcontractors pursuant to the Contract shall have the sole responsibility to take any and all needed action as reasonably necessary to protect the life, health and general occupational welfare of all personnel on the Site as well as the general public in and around the construction Site.

11. PREVAILING WAGES

The minimum wage rates for each craft or classification of all workmen needed to perform this Contract during the anticipated term hereof shall be governed by the Prevailing Rates, which are included in the General Provisions under Attachment 2.

12. EQUAL EMPLOYMENT OPPORTUNITY

The attention of bidders is particularly called to the requirements within the General Provisions, Attachments 1 and 3, which ensure that the employees and applicants for employment are not discriminated against because of their race, creed, color or national origin.

13. OTHER FEDERAL AND STATE REQUIREMENTS

The Contractor shall refer to the General Provisions, Attachment 1 and 3, for other Federal and State requirements for this Contract.

14. SUBCONTRACTS

The bidder is specifically advised that any person, firm, or other party to whom it is proposed to award a Subcontract under this Contract must be in accordance with the following:

- a. May have to submit Certification of Compliance with Executive Order 11246. Approval of the proposed Subcontract award cannot be given by the Owner unless and until the proposed Subcontractor has submitted the certification and/or other

evidence showing that it has fully complied with any reporting requirements to which it is or was subject.

- b. The Contractor shall notify the Owner in writing, accompanied with his/her proposal of the names of all Subcontractors proposed for the Work and the extent and character of the Work to be performed by each Subcontractor. No Subcontractor shall be permitted to perform any Work on the Project unless and until the Owner has notified the Contractor in writing that such Subcontractor has been approved. The Contractor shall supply proof, with his/her bid, that each proposed Subcontractor is particularly equipped and capable to perform such Work. Proof of qualifications and capability of proposed Subcontractors shall include the following:
 - 1. A financial statement certified by its accountants.
 - 2. A list of contracts successfully and satisfactorily carried to completion on work of a similar nature.
 - 3. A list of contracts presently underway, the percentage of completion of each contract and the name and address of the owner.
 - 4. A list of equipment to be utilized on this Project.
- c. Subcontracted Work shall not begin until approval has been secured from the Owner. It is understood, however, that any approval by the Owner for the subcontracting of any of the Work under the Contract in no way relieves the Contractor from his full obligations under the Contract. The Contractor shall be responsible for all acts or omissions of any Subcontractor or supplier and shall be liable for all damages caused by the acts or omissions of any Subcontractor or supplier.
- d. Subletting by Subcontractors shall not be permitted.

15. GUARANTEES

The following guarantees shall be required.

- a. A Performance Bond with good and sufficient surety or sureties for the protection of the Owner shall be executed in a penal amount of one hundred percent (100%) of the Contract Price.
- b. A Payment Bond with good and sufficient surety or sureties for the protection of persons furnishing material and labor of the Work shall be executed in a penal amount of one hundred percent (100%) of the Contract Price.

- c. In addition to the Contract securities noted above, a Maintenance Bond with good and sufficient surety or sureties in a penal amount of one hundred percent (100%) of the Final Contract Price shall be required upon completion of all Work. Said Bond shall guarantee against defective or inferior materials or workmanship which may develop during the period of one (1) year from the date of the completion and acceptance of Work performed under the Contract.

16. REQUIRED FORMS

The forms listed below must be submitted, as indicated, with every bid:

	<u>Bidder</u>	<u>Proposed Subcontractors</u>
• Form of Bid	X	
• Bid Guaranty	X	
• Non-Collusion Affidavit	X	
• Buy American Certificate	X	X
• Certification of Offeror/Bidder Regarding Tax Delinquency and Felony Convictions	X	X
• Contractor’s Certification of Eligibility	X	
• Statement of Bidder Indicating Previous Experience in Contracts Subject to the Equal Opportunity Clause	X	

17. LIQUIDATED DAMAGES

The amount of liquidated damages to be charged for the Contractor’s failure to complete the Work within the time specified in the Contract Agreement and under the conditions specified, shall be as stated in the “Agreement”.

18. DISADVANTAGED BUSINESS ENTERPRISE REQUIREMENTS

The DBE goal for this project is 8.9%.

FORM OF BID

SNOW REMOVAL EQUIPMENT (SRE) BUILDING PROJECT
ERIE INTERNATIONAL AIRPORT, TOM RIDGE FIELD

FROM: _____

Official Name and Address

1. The undersigned, having examined the existing conditions in the Project Area affecting the cost of the Work and the Contract Documents which includes, but is not limited to, the Invitation to Bid, Instruction to Bidders, Form of Bid, the Bid Guaranty, Agreement, Non-Collusion Affidavit, General Provisions, Technical Specifications, Drawings, and Form of Surety Bonds as prepared and prescribed by the ERIE REGIONAL AIRPORT AUTHORITY, hereby proposes to furnish all supervision, technical personnel, labor, materials, machinery, tools, equipment and services, including utility and transportation services and to perform and complete all Work required for the referenced Project all in accordance with the above-listed documents, for the prices provided in the Bid Schedule.
2. In submitting this bid, the bidder understands that the right is reserved by The ERIE REGIONAL AIRPORT AUTHORITY to reject any or all bids. If written notice of the acceptance of this bid is mailed, telegraphed or delivered in writing, to the undersigned within sixty (60) days after the opening thereof, or at any time thereafter before this bid is withdrawn, the undersigned agrees to execute and deliver a Contract in the prescribed form and furnish the required bonds within ten (10) days after the Contract is presented for signature.
3. Security in the amount of _____ Dollars (\$ _____), in the form of is submitted herewith in accordance with the INSTRUCTIONS TO BIDDERS. Separate surety must be included for each Contract.
4. Attached hereto is an affidavit of proof that the undersigned has not colluded with any person in respect to this bid or any other bid for the Contract for which this bid is submitted.
5. The bidder hereby acknowledges receipt of the following issues of addenda, if any, distributed by the Engineer.

Addendum No. _____	Date _____

BASIS OF AWARD

It is the intent of the Owner to award a Contract to the bidder with the lowest responsive and responsible total base bid meeting the requirements set forth in the Contract Documents and which does not exceed the funds available. The Owner shall have the right to waive informalities or irregularities in bids received and to accept bids which, in the Owner's judgement, are in the Owner's best interest.

In accordance with Item 14 of the Instructions to Bidders the Owner reserves the right to disqualify bids submitted by a bidder when the bidder proposes the utilization of Subcontractor(s) that are not acceptable to the Owner and/or does not satisfy the DBE goal or provide satisfactory documentation that a suitable good faith effort was made to satisfy the goal.

Provided the bids are in accordance with the requirements of these Contract Documents and the bids do not exceed the available funds, the award by the Owner shall be based on the lowest total responsive and responsible bid meeting the Contract Documents and approved by the ERIE REGIONAL AIRPORT AUTHORITY.

WORK COVERED BY CONTRACT DOCUMENTS

In first paragraph below, include an abbreviated description of the Work for Project identified in "Project Information" Article. See Evaluations. For single prime contracts, this article may be eliminated.

The Work of Project is defined by the Contract Documents and consists of the following:

In general, the scope of work for the project consists of constructing a new snow removal equipment building comprising approximately 13,200 SF, along with related site improvements on the approximately 1.5-acre parcel. The building includes nine (9) total bays; (6) bays with 18'-0" high speed overhead doors and three (3) bays with 28'-0" high-speed overhead doors. The bays are utilized to house the snow removal vehicles and equipment presently owned by the Airport Authority, and future equipment currently listed on the five-year CIP. Bays 7 and 8 include an overhead crane. Site improvements include a new asphalt drive, grading and associated utilities for the facility. This project is a multi-prime project consisting of the following four contracts: General/Site, Plumbing, Mechanical (HVAC), and Electrical Contracts.

Type of Contract:

Project will be constructed under coordinated, concurrent multiple contracts. See Section 011200 "Multiple Contract Summary" for a description of work included under each of the multiple contracts and for the responsibilities of Project coordinator. Contracts for this Project include the following:

C-1: General / Site Construction: A separate contract will be awarded to a General / Site Contractor for general building and site construction.

C-2: Plumbing Construction: A separate contract will be awarded to a Plumbing Contractor for the construction of plumbing and distribution systems.

C-3: Mechanical (HVAC) Construction: A separate contract will be awarded to a HVAC Contractor for the construction of heating/cooling (HVAC) equipment and distribution systems.

C-4: Electrical Construction: A separate contract will be awarded to an Electrical Contractor for the construction of electrical, and data equipment and distribution systems.

Official Use Only
Proposal Received
Date:
Time:
Witnesses:

Proposal Submitted For:	
Prime Contract	Description
C-1	General / Site Construction
C-2	Plumbing Construction
C-3	Mechanical (HVAC) Construction
C-4	Electrical Construction

C-1: GENERAL/SITE CONSTRUCTION BASE BID # 1:

CSI Division	Description	Breakdown	Subtotals	Totals
1	General:	General Conditions:	\$ <input type="text"/>	
		Temporary Facilities:	\$ <input type="text"/>	
		TOTAL:		\$ <input type="text"/>
2	Site Work:	Site Demolition:	\$ <input type="text"/>	
		Erosion & Sedimentation Control:	\$ <input type="text"/>	
		Bulk Excavation:	\$ <input type="text"/>	
		Site Grading:	\$ <input type="text"/>	
		Site – Storm Water:	\$ <input type="text"/>	
		Site - Sanitary Sewer:	\$ <input type="text"/>	
		Site – Natural Gas:	\$ <input type="text"/>	
		Site – Domestic Water:	\$ <input type="text"/>	
		Roadways and Parking Lots:	\$ <input type="text"/>	
		Site Concrete:	\$ <input type="text"/>	
		Landscaping:	\$ <input type="text"/>	
		TOTAL:		
3	Concrete:	Foundations	\$ <input type="text"/>	
		Slab on Grade	\$ <input type="text"/>	
		TOTAL:		\$ <input type="text"/>
4	Masonry:	Masonry walls	\$ <input type="text"/>	
		TOTAL:		\$ <input type="text"/>

7	Thermal & Moisture Protection:	Building Insulation:	\$ <input type="text"/>	
		Joint Sealants:	\$ <input type="text"/>	
		Other:	\$ <input type="text"/>	
		TOTAL:		\$ <input type="text"/>
8	Doors & Windows:	Hollow Metal Doors and Frames:	\$ <input type="text"/>	
		Overhead Coiling Doors:	\$ <input type="text"/>	
		Structured-Polycarbonate Panel Assemblies:	\$ <input type="text"/>	
		Door Hardware:	\$ <input type="text"/>	
		Other:	\$ <input type="text"/>	
		TOTAL:		\$ <input type="text"/>
9	Finishes:	Painting / Coatings:	\$ <input type="text"/>	
		Other:	\$ <input type="text"/>	
		TOTAL:		\$ <input type="text"/>
10	Specialties:	Fire Protection Specialties:	\$ <input type="text"/>	
		Other:	\$ <input type="text"/>	
		TOTAL:		\$ <input type="text"/>
13	Special Construction:	Metal Building Systems:	\$ <input type="text"/>	
		TOTAL:		\$ <input type="text"/>

28	Fire Alarm:	Fire Alarm System:	\$ <input style="width: 80%;" type="text"/>
	TOTAL:		\$ <input style="width: 80%;" type="text"/>
41	Conveying Systems:	Bridge Crane:	\$ <input style="width: 80%;" type="text"/>
	TOTAL:		\$ <input style="width: 80%;" type="text"/>
		TOTAL COST OF WORK:	\$ <input style="width: 80%;" type="text"/>
		TOTAL BID PROPOSAL:	\$ <input style="width: 80%;" type="text"/>

All General/Site Construction (C-1) complete as depicted in the Contract Documents, for the sum of:

_____ Dollars \$ _____
(WRITTEN)

C-2: PLUMBING CONSTRUCTION BASE BID # 1:

CSI Division	Description	Breakdown	Subtotals	Totals
15	Plumbing:			
		General Conditions:	\$ <input type="text"/>	
		Temporary Facilities:	\$ <input type="text"/>	
		Water, Waste, and Storm Piping:	\$ <input type="text"/>	
		Roof Drains / Emergency Drains:	\$ <input type="text"/>	
		Other:	\$ <input type="text"/>	
	TOTAL:			\$ <input type="text"/>
		TOTAL COST OF WORK:		\$ <input type="text"/>
		TOTAL BID PROPOSAL:		\$ <input type="text"/>

All Plumbing Construction (C-2) complete as depicted in the Contract Documents, for the sum of:

_____ Dollars \$ _____
(WRITTEN)

C-3: MECHANICAL (HVAC) CONSTRUCTION BASE BID # 1:

CSI Division	Description	Breakdown	Subtotals	Totals
15	Mechanical:			
		General Conditions:	\$ <input type="text"/>	
		Temporary Facilities:	\$ <input type="text"/>	
		HVAC Equipment:	\$ <input type="text"/>	
		Controls / DDC:	\$ <input type="text"/>	
		Other:	\$ <input type="text"/>	
	TOTAL:			\$ <input type="text"/>
		TOTAL COST OF WORK:		\$ <input type="text"/>
		TOTAL BID PROPOSAL:		\$ <input type="text"/>

All Mechanical Construction (C-3) complete as depicted in the Contract Documents, for the sum of:

_____ Dollars \$ _____
(WRITTEN)

C-4: ELECTRICAL CONSTRUCTION BASE BID # 1:

CSI Division	Description	Breakdown	Subtotals	Totals
16	Electrical:			
		General Conditions:	\$ <input type="text"/>	
		Temporary Facilities:	\$ <input type="text"/>	
		Site – Primary Service/ Distribution:	\$ <input type="text"/>	
		Site - Lighting:	\$ <input type="text"/>	
		Electrical Service / Distribution	\$ <input type="text"/>	
		Generator	\$ <input type="text"/>	
		Lighting	\$ <input type="text"/>	
		Lightning Protection System	\$ <input type="text"/>	
		Other:	\$ <input type="text"/>	
	TOTAL:			\$ <input type="text"/>
		TOTAL COST OF WORK:		\$ <input type="text"/>
		TOTAL BID PROPOSAL:		\$ <input type="text"/>

All Electrical Construction (C-4) complete as depicted in the Contract Documents, for the sum of:

_____ Dollars \$ _____
(WRITTEN)

TO BE COMPLETED IF ADDENDA ARE ISSUED:

The bidder acknowledges receipt of the Addenda hereinafter enumerated that have been issued during the period of bidding and agrees that said Addenda are included in the Contract Documents. The bidder shall list below the numbers and issuing dates of the Addenda received:

Addenda No.	Issuing Date
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Bidder - Insert Firm Name

PROPOSAL SIGNATURE PAGE

When the Bidder is an Individual:

(Signature)

Witness:

Date

When the Bidder is a Partnership:

(Partnership Name)

(Partner)

(Partner)

(Witness)

Date

When the Bidder is a Corporation:

(Corporation Name)

(President)/(Vice President)

(CORPORATE SEAL)

Date

ATTEST:

(Secretary/Treasurer)

BID GUARANTY

KNOW ALL MEN BY THESE PRESENTS, that we, _____

as Principal, and _____
_____, as Surety are held and firmly bound unto ERIE REGIONAL AIRPORT
AUTHORITY (hereinafter called the Owner), in the sum of _____ Dollars,
lawful money of the United States, for the payment of which sum well and truly to be made, we
bind ourselves, our heirs, executors, administrators, and successors, jointly and severally firmly by
these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the
accompanying bid, dated _____, 2019 for: **Snow Removal Equipment (SRE)
Building Project.**

NOW THEREFORE, if the Principal shall not withdraw said bid within the period specified therein
after the opening of the same, or, if no period be specified, within sixty (60) days after said
opening, and shall within the period specified therefore, or, if no period be specified, within ten
(10) days after the prescribed forms are presented to him for signature, enter into a written
Contract with the Owner in accordance with the bid accepted, and given bond with good and
sufficient surety, as may be required, for the faithful performance and proper fulfillment of such
Contract, or in the event of the withdrawal of said bid within the period specified, or the failure to
enter into such Contract and give such bond within the time specified, if the Principal or his Surety
shall pay the Owner ten percent (10%) of the amount specified in said bid as liquidated damages,
then the above obligation shall be void and of no effect, otherwise to remain in full force and
virtue.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their
several seals this ____ day of _____, 2019, the name and corporate seal of each
corporate party being hereto affixed and these presents duly signed by its undersigned
representative, pursuant to authority of its governing body.

(Individual Principals Sign Here)

IN PRESENCE OF:

_____ (SEAL)
(Individual Principal)

(Business Address)

_____ (SEAL)

Individual Principal)

(Corporate Principals Sign Here)

ATTEST

By: _____ (SEAL)
(Corporate Principal)

(Business Address)

(Surety Company Sign Here)

_____ (Corporate Surety)

_____ (Business Address)

(Power-of-Attorney for person signing for surety company must be attached to bond.)

INSTRUCTIONS FOR NON-COLLUSION AFFIDAVIT

1. This Non-Collusion Affidavit is material to any Contract awarded pursuant to this bid.
2. This Non-Collusion Affidavit must be executed by the member, officer or employee of the bidder who makes the final decision on prices and the amount quoted in the bid.
3. Bid rigging and other efforts to restrain competition, and making of false sworn statements in connection with the submission of bids are unlawful and may be subject to criminal prosecution. The person who signs the Affidavit should examine it carefully before signing and assure himself or herself that each statement is true and accurate, making diligent inquiry, as necessary, of all other persons employed by or associated with the bidder with responsibilities for the preparation, approval or submission of the bid.
4. In the case of a bid submitted by a joint venture, each party to the joint venture must be identified in the Bid Documents, and an Affidavit must be submitted separately on behalf of each party.
5. The term “complementary bid” as used in the Affidavit has the meaning commonly associated with that term in the bidding process, and includes the knowing submission of bids higher than the bid of another firm, any intentionally high or noncompetitive bid, and any other form of bid submitted for the purpose of giving a false appearance of competition.
6. Failure to file an Affidavit in compliance with these instructions shall result in disqualification of the bid.

NON-COLLUSION AFFIDAVIT

Contract/Bid No. _____

State of _____

ss:

County of _____

I state that I am _____ (Title) of _____ (Name of Firm) and that I am authorized to make this Affidavit on behalf of my firm, and its owners, directors, and officers. I am the person responsible in my firm for the price(s) and the amount of the bid.

I state that:

- (1) The price(s) and amount of this bid have been arrived at independently and without consultation, communication or agreement with any other contractor, bidder or potential bidder.
- (2) Neither the price(s) nor the amount of this bid, and neither the approximate price(s) nor approximate amount of this bid, have been disclosed to any other firm or person who is a bidder or potential bidder, and they will not be disclosed before bid opening.
- (3) No attempt has been made or will be made to induce any firm or person to refrain from bidding on this Contract, or to submit a bid higher than this bid, or to submit any intentionally high or noncompetitive bid or other form of complementary bid.
- (4) The bid of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive bid.
- (5) _____ (Name of my firm), its affiliates, subsidiaries, officers, directors and employees are not currently under investigation by any governmental agency and have not in the last four years been convicted or found liable for any act prohibited by State or Federal law in any jurisdiction, involving conspiracy or collusion with respect to bidding on any public contract, except as follows:

I state that _____ (Name of Firm) understands and acknowledges that the above representations are material and important, and will be relied on by the Owner in awarding the Contract for which this bid is submitted. I understand and my firm understands that any misstatement in this Affidavit is and shall be treated as fraudulent concealment from the Owner of the true facts relating to the submission of bids for this Contract.

(Name and Company Position)

SWORN to and subscribed before me this

day of _____ A.D. 2019.

My Commission Expires: _____

(NOTARIAL SEAL)

BUY AMERICAN CERTIFICATE

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 FAA 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 submit the appropriate Buy America certification (below) with all bids or offers on AIP funded projects. Bids or offers that are not accompanied by a completed Buy America certification must be rejected as nonresponsive.

Certificate of Buy American Compliance for Manufactured Products (Non-building construction projects, equipment acquisition projects)

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:
- a) Only installing steel and manufactured products produced in the United States, or;
 - b) Installing manufactured products for which the 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:

- 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 US domestic product
 - 3. To furnish US 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% 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 with the bid, a formal waiver request and required documentation that support 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 US domestic products at or above the approved US 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% 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% US 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 US domestic source product exceeds the total project cost using non-domestic product by 25%. The required documentation for a type 4 of waiver is:

- a) Detailed cost information for total project using US 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

**CERTIFICATION OF OFFEROR/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.

CONTRACTOR'S CERTIFICATION OF ELIGIBILITY

The bidder/offeror certifies, by submission of this proposal or acceptance of this Contract, that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency. It further agrees by submitting this proposal that it shall include this clause without modification in all lower tier transactions, solicitations, proposals, Contracts, and Subcontracts. Where the bidder/offeror/contractor or any lower tier participant is unable to certify to this statement, it shall attach an explanation to this solicitation/proposal.

That, the information above is true and complete to the best of my knowledge.

Name and Title (please print)

Signature _____ Date _____

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

STATEMENT OF BIDDER INDICATING PREVIOUS EXPERIENCE IN
CONTRACTS SUBJECT TO THE EQUAL OPPORTUNITY CLAUSE

This hereby certifies that _____ has previously had a contract subject to the Equal Opportunity Clause and that all report forms required in such contract have been filed with the proper agencies.

Signature: _____

Date: _____

If the bidder has not had a previous contract subject to the Equal Opportunity Clause, a compliance report, Standard Form (SF) 100 must be attached to this Proposal Form.

CONTRACT DOCUMENTS

AGREEMENT

THIS AGREEMENT, made this ____ day of _____, 2019, by and between the ERIE REGIONAL AIRPORT AUTHORITY, hereinafter referred to as the "Owner" and _____

(A Corporation existing under the laws of the State of) _____

(Partnership consisting of) _____

(An Individual trading as) _____

located in _____ in the State of _____

hereinafter referred to as the "Contractor".

WITNESSETH, that the parties hereto mutually agree as follows:

ARTICLE 1 - CONTRACT DOCUMENTS

The Contract Documents consist of all those documents listed in Article 9 all Addenda issued prior to execution of this Agreement, and all Modifications issued subsequent thereto. These form the Contract and all are as fully a part of the Contract as if attached to this Agreement or repeated herein. The applicable provisions of the contract shall be incorporated into each subcontract entered into by the Contractor.

ARTICLE 2 - THE WORK

The Contractor shall perform the Work required by the Contract Documents for:

**Erie International Airport Tom Ridge Field
Snow Removal Equipment (SRE) Building Project**

ARTICLE 3 - THE ARCHITECT/ENGINEER

The Architect/Engineer for this Project is:

Michael Baker International
Airsides Business Park
100 Airside Drive
Moon Township, PA 15108

ARTICLE 4 - CONTRACT SUM

The Owner shall pay the Contractor for the performance of the Work included under this Contract subject to additions and deductions by Change Order as provided in the General Provisions of the Contract.

The Estimated Contract Sum of: _____

_____ (\$ _____)

The final payment shall be based on the actual constructed quantities of Work and the Contract

Unit Prices.

ARTICLE 5 - TIME OF COMMENCEMENT AND COMPLETION

- a. The work to be performed under this Contract shall be commenced within three (3) business days after the date of "Notice to Proceed". All work on the **Snow Removal Equipment (SRE) Building Project** shall be completed within ninety (90) calendar days from the date of "Notice to Proceed."
- b. It is hereby understood and mutually agreed by and between the Contractor and the Owner, that the date of beginning, rate of progress, and the time for completion of the Work to be performed hereunder are essential conditions of this Contract; and it is further mutually understood and agreed that the Work embraced in this Contract shall be completed in the number of days specified above.

The Contractor agrees that said Work shall be prosecuted regularly, diligently, and uninterrupted at such rate of progress as will insure completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of Work described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual construction conditions prevailing in this locality.

IF THE SAID CONTRACTOR SHALL NEGLECT, FAIL OR REFUSE TO COMPLETE THE WORK WITHIN THE TIME HEREIN SPECIFIED, then the Contractor does hereby agree, as a part of consideration for the awarding of this Contract, to pay to the Owner **\$500.00** per calendar day past the indicated calendar days for the total contract.

Such payment will not be considered a penalty but as liquidated damages for such breach of Contract as hereinafter set forth, for each and every consecutive calendar day, including Saturdays, Sundays, and Holidays, that the Contractor shall be in default after the time stipulated in the Contract for completing the Work.

The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain.

ARTICLE 6 - FINAL PAYMENT

Upon the completion of all Work required by the Contract, the Engineer shall submit a Project Completion Certificate to the Owner and Contractor. Within ninety (90) days after filing of such Certificate and a final payment estimate issued by the Contractor, the Owner shall pay to the Contractor the full Contract Sum, less all prior payments. All prior payments including those related to Change Orders shall be subject to correction by the final payment.

ARTICLE 7 - BUY AMERICAN - STEEL AND MANUFACTURED PRODUCTS FOR CONSTRUCTION CONTRACTS

- (a) The Contractor agrees that only domestic steel and manufactured products shall be used by the Contractor, Subcontractors, materialmen, and suppliers in the performance of this Contract, as defined in the Buy American Certificate included in the bid and the Pennsylvania Grant Assurances included as Attachment 3 to the General Provisions.

ARTICLE 8 - MISCELLANEOUS PROVISIONS

Terms used in this Agreement which are defined in the General Provisions of the Contract shall have the meanings designated in those General Provisions.

ARTICLE 9 - CONTRACT DOCUMENTS

The Contract Documents, which constitute the entire Agreement between the Owner and the Contractor, except for Modifications issued after execution of this Agreement, are enumerated as follows:

- Invitation to Bid
- Instruction to Bidders
- Form of Bid
- Basis of Award
- Bid Schedule
- Bid Guaranty
- Instructions for Non-Collusion Affidavit
- Non-Collusion Affidavit
- Buy American Certificate
- Certification of Offeror/Bidder Regarding Tax Delinquency and Felony Convictions
- Contractor's Certificate of Eligibility
- Statement of Bidder Indicating Previous Experience in Contracts Subject to the Equal Opportunity Clause
- Agreement
- General Instructions for Bonds
- Performance Bond
- Payment Bond
- Maintenance Bond
- Affidavit
- No Lien Agreement
- Affidavit RE
- Partnership Certificate
- Corporate Certificate
- Notice of Responsible Employees
- Contractor's Certification of Non-Segregated Facilities
- Public Works Employment Verification Form
- General Provisions
- Technical Specifications
- Drawings

ARTICLE 10 – INSURANCE REQUIREMENTS

The Contractor shall procure and maintain insurance for protection from claims under Worker’s Compensation Acts, claims for damages because of bodily injury, including personal injury, sickness or disease or death of any and all employees or of any person other than such employees, and from claims or damages because of injury to or destruction of property, including loss of use resulting therefrom.

Worker Compensation and Employer’s Liability Insurance:

1. Worker’s Compensation – Pennsylvania Statutory Coverage.
2. Minimum amounts of Employer’s Liability Insurance shall be as follows:
 - \$1,000,000 – Bodily Injury
 - \$1,000,000 – Policy Limit
 - \$1,000,000 – Disease – Each Employee

General Liability Insurance:

- \$1,000,000 – General Aggregate over all interests
- \$1,000,000 – Each Occurrence for bodily injury and property damage
- \$1,000,000 - Products / Completed Operations Aggregate

Automobile Liability Insurance for all automobiles, trucks and similar equipment owned, leased, or rented:

Minimum amounts for Automobile Liability Insurance shall be as follows:

- \$1,000,000 – Bodily Injury (per person)
- \$1,000,000 – Bodily Injury (per accident)
- \$1,000,000 – Property Damage

Umbrella/Excess Policy:

\$4,000,000

Environmental Pollution Liability Insurance:

\$1,000,000 – Policy Limit

The Contractor shall, at its own expense, procure and maintain Environmental Protection Liability coverage in the amount of \$1,000,000 Policy Limit, insuring its operation, itself, and ERAA against any leaks, spills or environmental cleanups for the benefit of ERAA and itself.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement in four (4) duplicate counterparts, each of which shall be considered as an original, as of the day and year first above written.

WITNESS:

CONTRACTOR:

BY: _____

TITLE: _____

WITNESS:

ERIE REGIONAL AIRPORT AUTHORITY

(SEAL)

BY: _____
Chairman

GENERAL INSTRUCTIONS FOR BONDS

1. The "Bid Guaranty" form shall be used for the protection of the Owner in receiving bids. There shall be no deviation from this form.
2. The "Performance Bond" form shall be used for all Work or the furnishing of supplies whenever a bond is required. There shall be no deviation from this form.
3. The "Payment Bond" form, for the protection of persons supplying labor and material, shall be used on all Contracts where such Bond is required. This Bond shall provide that every person, co-partnership, association or corporation who, whether as Subcontractor or otherwise, has furnished material or supplied or performed labor in the prosecution of the Work, as above provided, and who has not been paid therefore, may sue in assumpsit on said Bond, in the name of the Owner, for his, their or its use, and prosecute the same to final judgement for such sum or sums as may be justly due him, them or it, and have execution thereon, but the Owner shall not be liable for the payment of any costs or expenses of any suit. There shall be no deviation from this form.
4. The "Maintenance Bond" form for the protection of the Owner shall be used on all Contracts where such Bond is required. There shall be no deviation from this form.
5. The surety on each bond must be a responsible surety company, which is qualified to do business in the Commonwealth of Pennsylvania and satisfactory to the Owner.
6. If the principals are partners, their individual names shall appear in the body of the bond, with the recital that they are partners composing a firm, naming it, and all the members of the firm shall execute the bond as individuals.
7. The signature of a witness shall appear in the appropriate place, attesting the signature of each individual party to the bond.
8. If the principal or surety is a corporation, the name of the State in which incorporated shall be inserted in the appropriate place in the body of the bond, and said instrument shall be executed and attested under the corporate seal, as indicated in the form. If the corporation has no corporate seal, the fact shall be stated, in which case a scroll or adhesive seal shall appear following the corporate name.
9. The official character and authority of the person or persons executing the bond for the principal, if a corporation, shall be certified by the secretary or assistant secretary, according to the form attached thereto. In lieu of such certificate, there may be attached to the bond, copies of so much of the records of the corporation as will show the official character and authority of the officer signing, duly certified by the secretary or assistant secretary, under the corporate seal, to be true copies.
10. The date of these bonds must not be prior to the date of the Contract in connection with which it is given.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____

as Principal, and _____

as Surety, are held and firmly bound unto the ERIE REGIONAL AIRPORT AUTHORITY (called the Obligee), in the full and just sum of _____

DOLLARS (\$ _____), lawful money of the United States, for payment of which sum well and truly to be made, we bind ourselves, our heirs, administrators, executors, successors, and assigns, jointly and severally, firmly by these presents:

WHEREAS said Principal has entered into a certain Contract with said Obligee dated _____, 2019 (hereinafter called the Contract) for: **Snow Removal Equipment (SRE) Building Project**, which Contract and the Specifications for said Work shall be deemed a part hereof as fully as if set out herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the Principal shall faithfully perform the Contract on his/her part at the time and in the manner therein provided including any and all warranties and representations of Principal set forth in said Contract, and satisfy all claims and demands incurred in or for the same, or growing out of the same, or for injury or damage to persons or property in the performance thereof, and shall fully indemnify and save harmless the said Obligee from any and all cost and damage which the said Obligee may suffer by reason of failure to do so, and shall fully reimburse and repay the said Obligee any and all outlay and expense which it may incur by reason of any such default, then this obligation shall be null and void; otherwise it shall remain in full force and virtue.

The said 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 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 to the Specifications.

Signed, sealed and delivered in five (5) counterparts this ____ day of
_____ 2019.

(Individuals Principals Sign Here)

In the presence of:

_____ (SEAL)
(Individual Principal)

_____ (SEAL)
(Individual Principal)

(Corporate Principals Sign Here)

ATTEST:

_____ By _____
(Corporate Principal)

(Surety Sign Here)

(Power-of-Attorney for person signing for surety company must be attached to the bond.)

PAYMENT BOND
(See Instructions)

KNOW ALL MEN BY THESE PRESENTS, that we _____

as Principal and _____

as Surety are held and firmly bound unto the ERIE REGIONAL AIRPORT AUTHORITY (hereinafter called the Obligee) in the penal sum of _____ DOLLARS _____, lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, personal representative, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS said Principal has entered into a certain Contract with said Obligee date _____ (hereinafter called the Contract) for: **Snow Removal Equipment (SRE) Building Project** which Contract and the Specifications for said Work shall be deemed a part hereof as fully as if set out herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if said Principal and all Subcontractors to whom any portion of the Work provided for in said Contract is sublet and all assignees of said Principal and of such Subcontractors shall promptly make payment for all labor performed, services rendered and materials furnished in the prosecution of the Work provided for in said Contract, or in any amendment or extension of or addition to said Contract, then the above obligation shall be void; otherwise to remain in full force and effect. Provided, however, that this Bond is subject to the following conditions and limitations:

- (a) All persons who have performed labor, rendered services or furnished materials or machinery as aforesaid shall have a direct right of action against the Principal and Surety on this Bond, which right of action shall be asserted in proceedings instituted in the State in which such labor was performed, services rendered or materials furnished. Insofar as permitted by the laws of such State, such right of action shall be asserted in a proceeding instituted in the name of the Obligee to the use and benefit of the person instituting such action and of all other persons having claims hereunder, and any other person having a claim hereunder shall have the right to be made a party to such proceeding (but not later than one year after the complete performance of said Contract and final settlement thereof) and to have such claim adjudicated in such action and judgment rendered thereon.
- (b) The surety shall not be liable hereunder for any damages or compensation recoverable under any workmen's compensation or employer's liability statute.
- (c) In no event shall the surety be liable for a greater sum than the penalty of this Bond, or subject to any suit, action or proceeding thereon that is instituted later than one year after the complete performance of said Contract and final settlement thereof.
- (d) As used herein, the term "person" refers to any person, firm or corporation who has

furnished materials or machinery to be used on or incorporated in the Work or the prosecution thereof provided for in said Contract, or in any amendment or extension of or addition to said Contract, or of any assignee of said Principal, or of any Subcontractor, and also anyone so engaged who performs the work of a laborer or of a mechanic regardless of any contractual relationship between the Principal, or any Subcontractor or any assignee or said Principal or of said Subcontractor, and such laborer or mechanic but shall not include office employees not regularly stationed at the site of the Work.

The said surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of this Contract or to the Work to be performed thereunder or the Specifications accompanying the same, shall in any way affect its obligations on this 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 to the Specifications.

Signed, sealed and delivered in five (5) counterparts this _____ day of _____, 2019

(Individual Principals Sign Here)

_____ (SEAL)

_____ (SEAL)

In the presence of:

_____ (SEAL)

_____ (SEAL)

(Corporate Principals Sign Here)

BY _____

(Surety Sign Here)

(Power-of-Attorney for person signing for surety company must be attached to bond.)

MAINTENANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we, _____

as Principal, and _____

as Surety are held and firmly bound unto the ERIE REGIONAL AIRPORT AUTHORITY (hereinafter called the Obligee) in the sum of _____

DOLLARS (\$ _____), for

the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into a certain Contract, hereto attached, with the Obligee dated _____, 2019, for: **Snow Removal Equipment (SRE) Building Project.**

NOW THEREFORE, if the Principal shall remedy without cost to the Obligee any defects which develop during a period of one (1) year from the date of completion and acceptance of the Work performed under said Contract provided such defects, in the judgment of the Obligee or his successor having jurisdiction in the premises, are caused by defective or inferior materials or workmanship, then this obligation shall be void; otherwise to remain in full force or virtue.

IN WITNESS WHEREOF, the above bounded parties have executed this instrument under their several seals this _____ day of _____, 2019, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

IN THE PRESENCE OF:

(Individual Principal) (SEAL)

(Business Address)

(Individual Principal) (SEAL)

(Business Address)

ATTEST:

(Corporate Principal)

(Business Address)

By: _____
(Affix Corporate Seal)

WITNESS:

(Corporate Surety)

(Business Address)

By: _____
(Affix Corporate Seal)

The rate of premium on this Bond is _____ per thousand. Total amount of premium charged, \$ _____. (The above must be filled in by corporate surety. Power-of-Attorney for person signing for surety company must be attached to the Bond.)

AFFIDAVIT

As an authorized representative of _____, I do hereby swear and affirm that neither _____ or any of its agents or employees has given or assigned or has agreed to give or assign any affiliated work or agreed to give any assistance in receiving any affiliated work to any officer, agent, or employee of the Erie Regional Airport Authority or to any concern that is in any way affiliated with any officer, agent, or employee of the Erie Regional Airport Authority, with an agreement or understanding to receive consideration for county business in connection with the above project and contract.

Signed: _____

Title: _____

Date: _____

Witness: _____

NO LIEN AGREEMENT

WHEREAS _____
(Name of Contractor)

has entered into an Agreement with the ERIE REGIONAL AIRPORT AUTHORITY to provide labor, materials and equipment for: **Snow Removal Equipment (SRE) Building Project.**

NOW, THEREFORE, it is hereby stipulated and agreed by and between the said parties, as part of the said Contract and for the consideration therein set forth, that neither the undersigned Contractor, any Subcontractor, or materialman, nor any other person furnishing labor or materials to the said Contractor under this Contract shall file a lien, commonly called a Mechanic's Lien for Work performed or materials furnished to the said Project, or to the grounds adjacent thereto.

This stipulation is made and intended to be filed with the Erie County Prothonotary within ten (10) days after date, in accordance with the requirements of the Commonwealth of Pennsylvania in such case provided.

IN WITNESS WHEREOF the said parties hereto have hereunder set their hands and seals this _____ day of _____, 2019.

CONTRACTOR: _____

WITNESS: BY: _____

TITLE: _____

ERIE REGIONAL AIRPORT AUTHORITY

WITNESS: BY: _____

AFFIDAVIT RE

ACCEPTING PROVISIONS OF THE WORKMEN'S COMPENSATION ACT

State of _____

SS:

County of _____

(Name of Officer, if corp.)

(Title of Officer, if corp.)

(Name of Contractor)

being duly sworn according to law deposes and says he/they/it has ___ accepted the provisions of the Workmen's Compensation Act or laws of the Commonwealth of Pennsylvania, with its supplements and amendments, and has ___ insured his/their/its liability thereunder in accordance with the terms of said Act with

(Company).

(Contractor)

By: _____

Title: _____

SWORN to and subscribed before me this

_____ day of _____ A.D. 2019

(NOTARIAL SEAL)

PARTNERSHIP CERTIFICATE

State of _____)

ss:

County of _____)

On this _____ day of _____ 2019, before me personally appeared, _____ known to me and known by me to be the person who executed the above instrument, who being by me first duly sworn, did depose and say that he is a general partner in the firm of _____ ; and that said firm consists of himself and _____ and that he executed the foregoing instrument on behalf of said firm for the uses and purposes stated herein.

Notary Public in and for the County

of _____

State of _____

(NOTARIAL SEAL)

CORPORATE CERTIFICATE

I, _____, certify that I am the secretary of the corporation named as Contractor in the foregoing Instrument, that _____, who signed the Instrument on behalf of the Contractor was then _____ of said corporation; that said Contractor was duly signed for and in behalf of said corporation by authority of its governing body, and is within the scope of its corporate power.

(Signature of Secretary)

(CORPORATE SEAL)

NOTICE OF RESPONSIBLE EMPLOYEES

The Contractor shall provide the Owner the names and phone numbers of three (3) employees, one of which shall be available at all times, to remedy emergency situations stemming from the construction activity during non-working hours.

Name _____

Phone Number _____

Name _____

Phone Number _____

Name _____

Phone Number _____

I hereby certify that one of the above persons will be available during non-working hours to remedy emergency situations stemming from the construction activity associated with the Contract:

By _____

Title _____

CONTRACTOR'S 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 at any location, under its control, where segregated facilities are maintained. The Federally Assisted Construction Contractor certifies that it shall not maintain or provide, for its employees, segregated facilities at any of its establishments and that it shall 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 room, work area, restrooms and washrooms, restaurants and other eating areas, timeclocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation and housing facilities provided 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 shall obtain identical certifications from proposed Subcontractors prior to the award of Subcontracts exceeding \$10,000.00 which are not exempt from the provisions of the equal opportunity clause and that he shall retain such certifications in his files.

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

Name and Title (Please Type)

Date _____

Signature_____

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



COMMONWEALTH OF PENNSYLVANIA

PUBLIC WORKS EMPLOYMENT VERIFICATION FORM

Date _____

Business or Organization Name (Employer) _____

Address _____

City _____ State _____ Zip Code _____

Contractor Subcontractor (check one)

Contracting Public Body _____

Contract/Project No _____

Project Description _____

Project Location _____

As a contractor/subcontractor for the above referenced public works contract, I hereby affirm that as of the above date, our company is in compliance with the Public Works Employment Verification Act ('the Act') through utilization of the federal E-Verify Program (EVP) operated by the United States Department of Homeland Security. To the best of my/our knowledge, all employees hired post January 1, 2013 are authorized to work in the United States.

It is also agreed to that all public works contractors/subcontractors will utilize the federal EVP to verify the employment eligibility of each new hire within five (5) business days of the employee start date throughout the duration of the public works contract. Documentation confirming the use of the federal EVP upon each new hire shall be maintained in the event of an investigation or audit.

I, _____, authorized representative of the company above, attest that the information contained in this verification form is true and correct and understand that the submission of false or misleading information in connection with the above verification shall be subject to sanctions provided by law.

Authorized Representative Signature

GENERAL PROVISIONS

Section 10 Definition of Terms

Whenever 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 interpreted as follows:

10-01 AASHTO. The American Association of State Highway and Transportation Officials, the successor association to AASHO.

10-02 Access road. The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public highway.

10-03 Advertisement. A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.

10-04 Airport Improvement Program (AIP). A grant-in-aid program, administered by the Federal Aviation Administration (FAA).

10-05 Air operations area (AOA). For the purpose of these specifications, 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.

10-06 Airport. 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; and airport buildings and facilities located in any of these areas, and includes a heliport.

10-07 ASTM International (ASTM). Formerly known as the American Society for Testing and Materials (ASTM).

10-08 Award. The Owner's notice to the successful bidder of the acceptance of the submitted bid.

10-09 Bidder. Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.

10-10 Building area. An area on the airport to be used, considered, or intended to be used for airport buildings or other airport facilities or rights-of-way together with all airport buildings and facilities located thereon.

10-11 Calendar day. Every day shown on the calendar.

10-12 Change order. 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 the work affected by such changes. The work, covered by a change order, must be within the scope of the contract.

10-13 Contract. The written agreement covering the work to be performed. The awarded contract shall include, but is not limited to: Advertisement, Contract Form, Proposal, Performance Bond, Payment Bond, any required insurance certificates, Specifications, Plans, and any addenda issued to bidders.

10-14 Contract item (pay item). A specific unit of work for which a price is provided in the contract.

10-15 Contract time. 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.

10-16 Contractor. 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.

10-17 Contractor's laboratory. The Contractor's quality control organization in accordance with the Contractor Quality Control Program.

10-18 Construction Safety and Phasing Plan (CSPP). 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.

10-19 Drainage system. The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.

10-20 Engineer. The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering inspection of the contract work and acting directly or through an authorized representative.

10-21 Equipment. All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the work.

10-22 Extra work. 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 Engineer to be necessary to complete the work within the intended scope of the contract as previously modified.

10-23 FAA. The Federal Aviation Administration of the U.S. Department of Transportation. When used to designate a person, FAA shall mean the Administrator or his or her duly authorized representative.

10-24 Federal specifications. The Federal Specifications and Standards, Commercial Item Descriptions, and supplements, amendments, and indices thereto are prepared and issued by the General Services Administration of the Federal Government.

10-25 Force account. Force account work is planning, engineering, or construction work done by the Sponsor's employees.

10-26 Inspector. An authorized representative of the Engineer assigned to make all necessary inspections and/or tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.

10-27 Intention of terms. 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 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, subject in each case to the final determination of the Owner.

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.

10-28 Laboratory. The official testing laboratories of the Owner or such other laboratories as may be designated by the Engineer. Also referred to as “Engineer’s Laboratory” or “quality assurance laboratory.”

10-29 Lighting. 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.

10-30 Major and minor contract items. 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.

10-31 Materials. Any substance specified for use in the construction of the contract work.

10-32 Notice to Proceed (NTP). A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.

10-33 Owner. 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.

10-34 Passenger Facility Charge (PFC). Per 14 CFR Part 158 and 49 USC § 40117, a PFC is a charge imposed by a public agency on passengers enplaned at a commercial service airport it controls.”

10-35 Pavement. The combined surface course, base course, and subbase course, if any, considered as a single unit.

10-36 Payment bond. The approved form of security furnished by the Contractor and his or her 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.

10-37 Performance bond. The approved form of security furnished by the Contractor and his or her surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.

10-38 Plans. 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.

10-39 Project. The agreed scope of work for accomplishing specific airport development with respect to a particular airport.

10-40 Proposal. 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.

10-41 Proposal guaranty. The security furnished with a proposal to guarantee that the bidder will enter into a contract if his or her proposal is accepted by the Owner.

10-42 Runway. The area on the airport prepared for the landing and takeoff of aircraft.

10-43 Specifications. 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.

10-44 Sponsor. 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.

10-45 Structures. 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; flexible and rigid pavements; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.

10-46 Subgrade. The soil that forms the pavement foundation.

10-47 Superintendent. The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the Engineer, and who shall supervise and direct the construction.

10-48 Supplemental agreement. A written agreement between the Contractor and the Owner covering (1) work that would increase or decrease the total amount of the awarded contract, or any major contract item, by more than 25%, such increased or decreased work being within the scope of the originally awarded contract; or (2) work that is not within the scope of the originally awarded contract.

10-49 Surety. The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.

10-50 Taxiway. For the purpose of this document, the term taxiway means 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.

10-51 Work. 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.

10-52 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.

END OF SECTION 10

Section 20 Proposal Requirements and Conditions

20-01 Advertisement (Notice to Bidders). See Bid Documents.

20-02 Qualification of bidders. Each bidder shall furnish the Owner satisfactory evidence of his or her competency to perform the proposed work. Such evidence of competency, unless otherwise specified, shall consist of statements covering the bidder's past experience on similar work, a list of equipment that would be available for the work, and a list of key personnel that would be available. In addition, each bidder shall furnish the Owner satisfactory evidence of his or her financial responsibility. Such 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 his or her 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 he or she is prequalified with the State Highway Division and is on the current "bidder's list" of the state in which the proposed work is located. Such evidence of State Highway Division prequalification may be submitted as evidence of financial responsibility in lieu of the certified statements or reports specified above.

Each bidder shall submit "evidence of competency" and "evidence of financial responsibility" to the Owner at the time of bid opening.

20-03 Contents of proposal forms. The Owner shall furnish bidders with proposal forms. All papers bound with or attached to the proposal forms are necessary parts and must not be detached.

The plans, specifications, and other documents designated in the proposal form shall be considered a part of the proposal whether attached or not.

20-04 Issuance of proposal forms. The Owner reserves the right to refuse to issue a proposal form to a prospective bidder should such bidder be 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 hereinafter provided in the subsection 40-02 titled ALTERATION OF WORK AND QUANTITIES of Section 40 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 as to the character, quality, and quantities of work to be performed, materials to be furnished, and as 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 as to the conditions to be encountered in performing the work and as to 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 his or her 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 his or her proposal on the forms furnished by the Owner. All blank spaces in the proposal forms 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 for which they propose to do for each pay item furnished in the proposal. In case of conflict between words and numerals, the words, unless obviously incorrect, shall govern.

The bidder shall sign the proposal correctly and in ink. If the proposal is made by an individual, his or her 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 under the laws of which 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 his or her 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 Sponsor's invitation for bid. It is the Sponsor'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 49 CFR § 18.36(b)(8). 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.

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 certified check, or other specified acceptable collateral, in the amount specified in the proposal form. Such check, or collateral, shall be made payable to the Owner.

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 advertisement 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 or by fax and/or email 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 the subsection 20-04 titled ISSUANCE OF PROPOSAL FORMS of this section.

END OF SECTION 20

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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 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 the subsection 20-09 titled IRREGULAR PROPOSALS of Section 20.

b. If the bidder is disqualified for any of the reasons specified in the subsection 20-14 titled DISQUALIFICATION OF BIDDERS of Section 20.

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.

Award of the contract shall be made by the Owner to the lowest, qualified bidder whose proposal conforms to the cited requirements of the Owner.

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 the subsection 30-07 titled APPROVAL OF CONTRACT of this section.

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 subsection 30-01 titled CONSIDERATION OF PROPOSALS of this section. 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 the subsection 30-05 titled REQUIREMENTS OF CONTRACT BONDS of this section.

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 the subsection 30-05 titled 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 15 calendar day period specified in the subsection 30-06 titled 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 liquidation of 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 and shall have the right to make such alterations in the work as may be necessary or desirable to complete the work originally intended in an acceptable manner. Unless otherwise specified herein, the Engineer shall be and is hereby authorized to make such alterations in the work as may increase or decrease the originally awarded contract quantities, provided that the aggregate of such alterations does not change the total contract cost or the total cost of any major contract item by more than 25% (total cost being based on the unit prices and estimated quantities in the awarded contract). Alterations that do not exceed the 25% limitation shall not invalidate the contract nor release the surety, and the Contractor agrees to accept payment for such alterations as if the altered work had been a part of the original contract. These alterations that are for work within the general scope of the contract shall be covered by "Change Orders" issued by the Engineer. Change orders for altered work shall include extensions of contract time where, in the Engineer's opinion, such extensions are commensurate with the amount and difficulty of added work.

Should the aggregate amount of altered work exceed the 25% limitation hereinbefore specified, such excess altered work shall be covered by supplemental agreement. 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.

Supplemental agreements shall be approved by the FAA and shall include all applicable Federal contract provisions for procurement and contracting required under AIP. Supplemental agreements shall also require consent of the Contractor's surety and separate performance and payment bonds.

40-03 Omitted items. The Engineer may, in the Owner's best interest, omit from the work any contract item, except major contract items. 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 the subsection 90-04 titled PAYMENT FOR OMITTED ITEMS of Section 90.

40-04 Extra work. Should acceptable completion of the contract require the Contractor to perform an item of work for which no basis of payment has been provided in the original contract or previously issued change orders or supplemental agreements, the same shall be called "Extra Work." Extra Work that is within the general scope of the contract shall be covered by written change order. Change orders for such 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 Engineer's opinion, is necessary for completion of such Extra Work.

When determined by the Engineer to be in the Owner's best interest, the Engineer may order the Contractor to proceed with Extra Work as provided in the subsection 90-05 titled PAYMENT FOR EXTRA WORK of Section 90. 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 the subsection 10-48 titled SUPPLEMENTAL AGREEMENT of Section 10.

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.

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.

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 his or her own operations and the operations of all subcontractors as specified in the subsection 80-04 titled LIMITATION OF OPERATIONS of Section 80. 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 the subsection 70-15 titled CONTRACTOR'S RESPONSIBILITY FOR UTILITY SERVICE AND FACILITIES OF OTHERS in Section 70.

b. With respect to his or her 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.

c. When the contract requires the maintenance of vehicular traffic on 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 such road, street, or highway open to all traffic and shall provide such maintenance as may be required to accommodate traffic. The Contractor shall be responsible for the repair 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.

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 Engineer shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the Engineer in accordance with the provisions of the contract.

Except as provided in the subsection 40-07 titled RIGHTS IN AND USE OF MATERIALS FOUND IN THE WORK of this section, 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.

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 either embankment or waste, the Contractor may at his or her option either:

- a. Use such material in another contract item, providing such use is approved by the Engineer 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 Engineer; 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 Engineer's approval in advance of such use.

Should the Engineer 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 his or her own 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 Engineer 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 his or her 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 such property Owner.

END OF SECTION 40

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Section 50 Control of Work

50-01 Authority of the Engineer. The Engineer shall decide any and all questions which may arise as to the quality and acceptability of materials furnished, work performed, and as to the manner of performance and rate of progress of the work. The Engineer shall decide all questions that may arise as to the interpretation of the specifications or plans relating to the work. The Engineer shall determine the amount and quality of the several kinds of work performed and materials furnished which are to be paid for the under contract.

The Engineer does not have the authority to accept pavements that do not conform to FAA 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 Engineer 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 his or her opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, the Engineer will advise the Owner of his or her determination that the affected work be accepted and remain in place. In this event, the Engineer 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. The Engineer's determination and recommended contract price adjustments will be based on sound engineering judgment and such tests or retests of the affected work as are, in the Engineer's opinion, needed. Changes in the contract price shall be covered by contract change order or supplemental agreement as applicable.

If the Engineer 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 Engineer's written orders.

For the purpose of this subsection, 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 Engineer'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 Engineer's opinion, such compliance is essential to provide an acceptable finished portion of the work.

For the purpose of this subsection, the term "reasonably close conformity" is also intended to provide the Engineer with the authority, after consultation with the FAA, to use sound engineering judgment in his or her determinations as to acceptance of work that is not in strict conformity, but will provide a finished product equal to or better than that intended by the requirements of the contract, plans and specifications.

The Engineer 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. 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 Special Provisions conflict with General Provisions or Technical Specifications, the 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 Engineer for an interpretation and decision, and such decision shall be final.

SPECIAL PROVISIONS:

1. DEFINITION OF NOTICE

Where in any of the Contract Documents there is any provision in respect to the giving of any notice, such notice shall be deemed to have been given to the Owner, when written notice shall be delivered to the Owner, or shall have been placed in the United States Mails, postage prepaid, or through private carrier, all requiring signatures, addressed to the Owner at the place where the bids or proposals for the Contract were opened; as to the Contractor, when a written notice shall be delivered to the chief representative of the Contractor at the Site or by sending by certified or registered mail, postage prepaid, such written notice in the United States Mails addressed to the Contractor at the place stated in the papers prepared by him to accompany his proposal as the address of his permanent place of business.

2. APPROVAL AND ACCEPTANCE

Approval and acceptance in these contract documents or Contractor prepared specifications shall mean approval and acceptance by the Owner, but no acceptance by the Owner shall bind the Owner in case of proven defective Work or other clear violations of the Contract; nor shall approval of material or equipment before same is brought on the premises be held to constitute acceptance, in case such Items are found not to comply with Specification Requirements.

3. PROVISIONS REQUIRED BY LAW DEEMED INSERTED

Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, upon application of either party, the Contract shall forthwith be then physically amended to make such insertions.

4. CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE CONTRACT

If the Work shall be stopped by order of the Court or any other public authority for a period of ninety (90) days without act or fault of the Contractor or any agents, servants, employees or Subcontractors, the

Contractor may, upon ten (10) days notice to the Owner, terminate the Contract, in which event the Owner shall pay for all Work completed and any expense sustained, plus a reasonable profit.

50-04 Cooperation of Contractor. The Contractor will be supplied with five copies each of the plans and specifications. The Contractor shall have available on the work at all times one copy each of the plans and specifications. Additional 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 Engineer and his or her 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 his or her 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 Engineer or his or her authorized representative.

50-05 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 so as 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 his or her contract and shall protect and save 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 his or her work and shall place and dispose of the materials being used so as not to interfere with the operations of the other Contractors within the limits of the same project. The Contractor shall join his or her work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

50-06 Construction layout and stakes. The Engineer shall establish horizontal and vertical control only. The Contractor must establish all layout required for the construction of the work. Such stakes and markings as the Engineer may set for either their own or the Contractor's guidance shall be preserved by the Contractor. In case of negligence on the part of the Contractor, or their employees, resulting in the destruction of such stakes or markings, an amount equal to the cost of replacing the same may be deducted from subsequent estimates due the Contractor at the discretion of the Engineer.

The Contractor will be required to furnish all lines, grades and measurements from the control points necessary for the proper execution and control of the work contracted for under these specifications.

The Contractor must give copies of survey notes to the Engineer for each area of construction and for each placement of material as specified to allow the Engineer to make periodic checks for conformance with plan grades, alignments and grade tolerances required by the applicable material specifications. All surveys must be provided to the Engineer prior to commencing work items that will cover or disturb the survey staking as set by the Contractor's surveyor. Survey(s) and notes shall be provided in the following format(s): AutoCAD 2016 (survey) and Microsoft Word and/or Adobe PDF (notes). 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.

Construction Staking and Layout includes but is not limited to:

- a.** Clearing and Grubbing perimeter staking
- b.** Rough Grade slope stakes at 100-foot (30-m) stations
- c.** Drainage Swales slope stakes and flow line blue tops at 50-foot (15-m) stations

Subgrade blue tops at 25-foot (7.5-m) stations and 25-foot (7.5-m) offset distance (maximum) for the following section locations:

- a.** Runway – minimum five (5) per station
- b.** Taxiways – minimum three (3) per station
- c.** Holding apron areas – minimum three (3) per station
- d.** Roadways – minimum three (3) per station

Base Course blue tops at 25-foot (7.5-m) stations and 25-foot (7.5-m) offset distance (maximum) for the following section locations:

- a.** Runway – minimum five (5) per station
- b.** Taxiways – minimum three (3) per station
- c.** Holding apron areas – minimum three (3) per station

Pavement areas:

- a.** Edge of Pavement hubs and tacks (for stringline by Contractor) at 100-foot (30-m) stations.
- b.** Between Lifts at 25-foot (7.5-m) stations for the following section locations:
 - (1)** Runways – each paving lane width
 - (2)** Taxiways – each paving lane width
 - (3)** Holding areas – each paving lane width
- c.** After finish paving operations at 50-foot (15-m) stations:
 - (1)** All paved areas – Edge of each paving lane prior to next paving lot
- d.** Shoulder and safety area blue tops at 50-foot (15-m) stations and at all break points with maximum of 50-foot (15-m) offsets.
- e.** Fence lines at 100-foot (30-m) stations minimum.
- f.** Electrical and Communications System locations, lines and grades including but not limited to duct runs, connections, fixtures, signs, lights, Visual Approach Slope Indicators (VASIs), Precision Approach Path Indicators (PAPIs), Runway End Identifier Lighting (REIL), Wind Cones, Distance Markers (signs), pull boxes and manholes.
- g.** Drain lines, cut stakes and alignment on 25-foot (7.5-m) stations, inlet and manholes.
- h.** Painting and Striping layout (pinned with 1.5 inch PK nails) marked for paint Contractor. (All nails shall be removed after painting).
- i.** Laser, or other automatic control devices, shall be checked with temporary control point or grade hub at a minimum of once per 400 feet (120 m) per pass (that is, paving lane).

The establishment of Survey Control and/or reestablishment of survey control shall be by a State Licensed Land Surveyor.

Controls and stakes disturbed or suspect of having been disturbed shall be checked and/or reset as directed by the Engineer without additional cost to the Owner.

50-07 Automatically controlled equipment. Whenever batching or mixing plant equipment is required to be operated automatically under the contract and a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually or by other methods for a period 48 hours following the breakdown or malfunction, provided this method of operations will produce results which conform to all other requirements of the contract.

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

Inspectors are authorized to notify the Contractor or his or her 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 Engineer 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 Engineer 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 Engineer 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.

Any work done or materials used without supervision or inspection by an authorized representative of the Owner may be ordered removed and replaced at the Contractor's expense unless the Owner's representative failed to inspect after having been given reasonable notice in writing that the work was to be performed.

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 Engineer as provided in the subsection 50-02 titled CONFORMITY WITH PLANS AND SPECIFICATIONS of this section.

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 the subsection 70-14 titled CONTRACTOR'S RESPONSIBILITY FOR WORK of Section 70.

No removal work made under provision of this subsection shall be done without lines and grades having been established by the Engineer. Work done contrary to the instructions of the Engineer, work done beyond the lines shown on the plans or as established by the Engineer, 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 Engineer made under the provisions of this subsection, the Engineer will have authority to cause unacceptable work to be remedied or removed and replaced and unauthorized work to be removed and to deduct the costs incurred by the Owner from any monies due or to become due 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 shall be responsible for all damage done by his or her hauling equipment and shall correct such damage at his or her own expense.

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 the subsection 50-12 titled MAINTENANCE DURING CONSTRUCTION of this section, the Engineer 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 Engineer'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 deducted from monies due or to become due 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 Engineer to make final inspection of that unit. If the Engineer finds upon inspection that the unit has been satisfactorily completed in compliance with the contract, the Engineer 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 Engineer 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 Engineer 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 Engineer will give the Contractor the necessary instructions for correction of same and the Contractor shall immediately comply with and execute such instructions. 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 Engineer 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 Engineer in writing of his or her 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 Engineer 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 Engineer 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 Engineer 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.

END OF SECTION 50

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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 complete statements to the Engineer as to the origin, composition, and manufacture of all materials to be used in the work. Such statements shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

At the Engineer's option, materials may be approved at the source of supply before delivery is stated. 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.

The Contractor shall furnish airport lighting equipment that conforms to the requirements of cited materials specifications. In addition, where an FAA specification for airport lighting equipment is cited in the plans or specifications, the Contractor shall furnish such equipment that is:

a. Listed in advisory circular (AC) 150/5345-53, Airport Lighting Equipment Certification Program, and Addendum that is in effect on the date of advertisement; and,

b. Produced by the manufacturer as listed in the Addendum cited above for the certified equipment part number.

60-02 Samples, tests, and cited specifications. Unless otherwise designated, all materials used in the work shall be inspected, tested, and approved by the Engineer before incorporation in the work. Any work in which untested materials are used without approval or written permission of the Engineer 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 Engineer, shall be removed at the Contractor's expense.

Unless otherwise designated, quality assurance tests 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, will be made by and at the expense of the Engineer.

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, including the Contractor's representative at his or her request. Unless otherwise designated, samples for quality assurance will be taken by a qualified representative of the Engineer. 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 Engineer.

The Contractor shall employ a testing organization to perform all Contractor required Quality Control tests. The Contractor shall submit to the Engineer resumes on all testing organizations and individual persons who will be performing the tests. The Engineer will determine if such persons are qualified. All the test data shall be reported to the Engineer after the results are known. A legible, handwritten copy of all test data shall be given to the Engineer daily, along with printed reports, in an approved format, on a weekly basis. After completion of the project, and prior to final payment, the Contractor shall submit a

final report to the Engineer showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests.

60-03 Certification of compliance. The Engineer may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer's certificates of compliance 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.

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 Engineer.

When a material or assembly is specified by "brand name or equal" and the Contractor elects to furnish the specified "brand name," 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.

Should the Contractor propose to furnish an "or equal" material or assembly, the Contractor shall furnish the manufacturer's certificates of compliance as hereinbefore described for the specified brand name material or assembly. However, the Engineer shall be the sole judge as to whether the proposed "or equal" is suitable for use in the work.

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

60-04 Plant inspection. The Engineer or his or her authorized representative may inspect, at its source, any specified material or assembly to be used in the work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the work and to obtain samples required for acceptance of the material or assembly.

Should the Engineer conduct plant inspections, the following conditions shall exist:

- a. The Engineer shall have the cooperation and assistance of the Contractor and the producer with whom the Engineer has contracted for materials.
- b. The Engineer shall have full entry at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.
- c. If required by the Engineer, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Office or working space should be conveniently located with respect to the plant.

It is understood and agreed that the Owner shall have the right to retest any material that has been tested and approved at the source of supply after it has been delivered to the site. The Engineer shall have the right to reject only material which, when retested, does not meet the requirements of the contract, plans, or specifications.

60-05 Engineer's field office. The General Contractor shall furnish for the duration of the project one building for the use of the field Engineers and inspectors, as a field office. This facility shall be an approved weatherproof building in accordance with the General Conditions of the Technical

Specifications. This building shall be located conveniently near to the construction and shall be separate from any building used by the Contractor. The Contractor shall furnish photocopy machine, water, sanitary facilities, heat, air conditioning, and electricity. The Contractor and the Contractor's superintendent shall provide all reasonable facilities to enable to the Engineer to inspect the workmanship and materials used into the work.

60-06 Storage of materials. Materials shall be so stored as 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 Engineer. 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, the storage of materials and the location of the Contractor's plant and parked equipment or vehicles shall be as directed by the Engineer. 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 Engineer 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 his or her entire 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 Engineer.

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 Engineer has approved its use in the work.

60-08 Owner furnished materials. The Contractor shall furnish all materials required to complete the work, except those specified, if any, to be furnished by the Owner. Owner-furnished materials shall be made available to the Contractor at the location specified.

All costs of handling, transportation from the specified location to the site of work, storage, and installing Owner-furnished materials shall be included in the unit price bid for the contract item in which such Owner-furnished material is used.

After any Owner-furnished material has been delivered to the location specified, the Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies that may occur during the Contractor's handling, storage, or use of such Owner-furnished material. The Owner will deduct from any monies due or to become due the Contractor any cost incurred by the Owner in making good such loss due to the Contractor's handling, storage, or use of Owner-furnished materials.

END OF SECTION 60

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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 his or her 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) is indicated as follows:

Service	Contact	Phone	Email
FAA	Eric Marendt	814.838.3131 ext. 201	Eric.Marendt@faa.gov
National Fuel	James Kennedy	716.857.7368	KennedyJ@natfuel.com
Erie Water Works	Michael Dzurko	814.870.8000 ext. 204	mdzurko@eriewaterworks.org
Millcreek Township Sewer Authority	David Wright	804.835.6721 ext. 354	dwright@millcreektownship.com

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 Engineer.

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 Engineer, 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 aid participation. For Airport Improvement Program (AIP) contracts, the United States Government has agreed to reimburse the Owner for some portion of the contract costs. Such reimbursement is made from time to time upon the Owner's request to the FAA. In consideration of the United States Government's (FAA's) agreement with the Owner, the Owner has included provisions in this contract pursuant to the requirements of Title 49 of the USC and the Rules and Regulations of the FAA that pertain to the work.

As required by the USC, the contract work is subject to the inspection and approval of duly authorized representatives of the FAA Administrator, and is further subject to those provisions of the rules and regulations that are cited in the contract, plans, or specifications.

No requirement of the USC, the rules and regulations implementing the USC, or this contract shall be construed as making the Federal Government 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 shall provide and maintain in a neat, sanitary condition such accommodations for the use of his or her employees as may be necessary to comply with the requirements of the state and local Board of Health, or of other bodies or tribunals having jurisdiction.

Attention is directed to Federal, state, and local laws, rules and regulations concerning construction safety and health standards. The Contractor shall not require any worker to work in surroundings or under conditions that are unsanitary, hazardous, or dangerous to his or her health or safety.

70-07 Public convenience and safety. The Contractor shall control his or her operations and those of his or her 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 his or her own operations and those of his or her subcontractors and all suppliers in accordance with the subsection 40-05 titled MAINTENANCE OF TRAFFIC of Section 40 hereinbefore specified and shall limit such operations for the convenience and safety of the traveling public as specified in the subsection 80-04 titled LIMITATION OF OPERATIONS of Section 80 hereinafter.

70-08 Barricades, warning signs, and hazard markings. The Contractor shall furnish, erect, and maintain all barricades, warning signs, and markings for hazards necessary to protect the public and the work. When used during periods of darkness, such barricades, warning signs, and hazard markings shall be suitably illuminated. Unless otherwise specified, barricades, warning signs, and markings for hazards that are in the air operations area (AOAs) shall be a maximum of 18 inches (0.5 m) high. Unless otherwise specified, barricades shall be spaced not more than 4 feet (1.2 m) apart. Barricades, warning signs, and markings shall be paid for under subsection 40-05.

For vehicular and pedestrian traffic, the Contractor shall furnish, erect, and maintain barricades, warning signs, lights and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices.

When the work requires closing an air operations area of the airport or portion of such area, the Contractor shall furnish, erect, and maintain temporary markings and associated lighting conforming to the requirements of advisory circular (AC) 150/5340-1, Standards for Airport Markings.

The Contractor shall furnish, erect, and maintain markings and associated lighting of open trenches, excavations, temporary stock piles, and the Contractor's parked construction equipment that may be

hazardous to the operation of emergency fire-rescue or maintenance vehicles on the airport in reasonable conformance to AC 150/5370-2, Operational Safety on Airports During Construction.

The Contractor shall identify each motorized vehicle or piece of construction equipment in reasonable conformance to AC 150/5370-2.

The Contractor shall furnish and erect all barricades, warning signs, and markings for hazards prior to commencing work that requires such erection and shall maintain the barricades, warning signs, and markings for hazards until their removal is directed by the Engineer.

Open-flame type lights shall not be permitted.

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 Engineer 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 his or her 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 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 his or her own 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 save harmless the Engineer and the Owner and their officers, 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 his or her 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, his or her

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. Should it be 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 shall be specified herein and indicated on the plans. When so specified, the Contractor shall complete such portions of the work on or before the date specified or as otherwise specified. The Contractor shall make his or her own estimate of the difficulties involved in arranging the work to permit such beneficial occupancy by the Owner as described on the plans.

Upon completion of any portion of the work listed above, such portion shall be accepted by the Owner in accordance with the subsection 50-14 titled PARTIAL ACCEPTANCE of Section 50.

No portion of the work may be opened by the Contractor for public use until ordered by the Engineer in writing. Should it become necessary to open a portion of the work to public traffic on a temporary or intermittent basis, such openings shall be made when, in the opinion of the Engineer, 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 his or her expense.

The Contractor shall make his or her 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.

Contractor shall be required to conform to safety standards contained AC 150/5370-2 (see Special Provisions).

Contractor shall refer to the approved Construction Safety Phasing Plan (CSPP) to identify barricade requirements and other safety requirements prior to opening up sections of work to traffic.

70-14 Contractor's responsibility for work. Until the Engineer's final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with the subsection 50-14 titled PARTIAL ACCEPTANCE of Section 50, 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 his or her 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 the subsection 70-04 titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section, 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 the Owners are indicated as follows:

Service	Contact	Phone	Email
FAA	Eric Marendt	814.838.3131 ext. 201	Eric.Marendt@faa.gov
National Fuel	James Kennedy	716.857.7368	KennedyJ@natfuel.com
Erie Water Works	Michael Dzurko	814.870.8000 ext. 204	mdzurko@eriewaterworks.org
Millcreek Township Sewer Authority	David Wright	804.835.6721 ext. 354	dwright@millcreektownship.com

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 his or her plan of operations. Such notification shall be in writing addressed to THE PERSON TO CONTACT as provided in this subsection and subsection 70-04 titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section. A copy of each notification shall be given to the Engineer.

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 Engineer.

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 Engineer 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 Engineer 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 his or her surety.

70-15.1 FAA facilities and cable runs. The Contractor is hereby advised that the construction limits of the project may include existing facilities and buried cable runs that are owned, operated and maintained by the FAA. The Contractor, during the execution of the project work, shall comply with the following:

a. The Contractor shall permit FAA maintenance personnel the right of access to the project work site for purposes of inspecting and maintaining all existing FAA owned facilities.

b. The Contractor shall provide notice to the FAA Air Traffic Organization (ATO)/Technical Operations/System Support Center (SSC) Point-of-Contact through the airport a minimum of seven (7) calendar days prior to commencement of construction activities in order to permit sufficient time to locate and mark existing buried cables and to schedule any required facility outages.

c. If execution of the project work requires a facility outage, the Contractor shall contact the FAA Point-of-Contact through the Airport Owner a minimum of 72 hours prior to the time of the required outage.

d. Any damage to FAA cables, access roads, or FAA facilities during construction caused by the Contractor's equipment or personnel whether by negligence or accident will require the Contractor to repair or replace the damaged cables, access road, or FAA facilities to FAA requirements. The Contractor shall not bear the cost to repair damage to underground facilities or utilities improperly located by the FAA.

e. If the project work requires the cutting or splicing of FAA owned cables, the FAA Point-of-Contact through the Airport Owner shall be contacted a minimum of 72 hours prior to the time the cable work commences. The FAA reserves the right to have a FAA representative on site to observe the splicing of the cables as a condition of acceptance. All cable splices are to be accomplished in accordance with FAA specifications and require approval by the FAA Point-of-Contact as a condition of acceptance by the Owner. The Contractor is hereby advised that FAA restricts the location of where splices may be installed. If a cable splice is required in a location that is not permitted by FAA, the Contractor shall furnish and install a sufficient length of new cable that eliminates the need for any splice.

70-16 Furnishing rights-of-way. The Owner will be responsible for furnishing all rights-of-way upon which the work is to be constructed in advance of the Contractor's operations.

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, his or her 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 his or her surety, or both, such overpayment as may be sustained, or by failure on the part of the Contractor to fulfill his or her 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, bitumens, 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 his or her 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 Engineer. The Engineer 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 the subsection 40-04 titled EXTRA WORK of Section 40 and the subsection 90-05 titled PAYMENT FOR EXTRA WORK of Section 90. If appropriate, the contract change order or supplemental agreement shall include an extension of contract time in accordance with the subsection 80-07 titled DETERMINATION AND EXTENSION OF CONTRACT TIME of Section 80.

END OF SECTION 70

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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 Engineer.

The Contractor shall provide copies of all subcontracts to the Engineer. 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 his or her 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.

80-02 Notice to proceed. The notice to proceed shall state the date on which it is expected the Contractor will begin the construction and from which date contract time will be charged. The Contractor shall begin the work to be performed under the contract within 10 days of the date set by the Engineer in the written notice to proceed, but in any event, the Contractor shall notify the Engineer at least 24 hours in advance of the time actual construction operations will begin. The Contractor shall not commence any actual construction 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 progress schedule for the Engineer's approval within 10 days after the effective date of the notice to proceed. The Contractor's progress schedule, when approved by the Engineer, may be used to establish major construction operations and to check on the progress of the work. 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 Engineer'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 Engineer at least 24 hours in advance of resuming operations.

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

80-04 Limitation of operations. The Contractor shall control his or her operations and the operations of his or her 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 his or her operations within an AOA of the airport, the work shall be coordinated with airport operations (through the Engineer) at least 48 hours prior to commencement of such work. The Contractor shall not close an AOA until so authorized by the Engineer and until the necessary temporary marking and associated lighting is in place as provided in the subsection 70-08 titled BARRICADES, WARNING SIGNS, AND HAZARD MARKINGS of Section 70.

When the contract work requires the Contractor to work within an AOA of the airport on an intermittent basis (intermittent opening and closing of the AOA), the Contractor shall maintain constant communications as specified; immediately obey all instructions to vacate the AOA; immediately obey all

instructions to resume work in such AOA. Failure to maintain the specified communications or to obey instructions shall be cause for suspension of the Contractor's operations in the AOA until the satisfactory conditions are provided. The following AOA cannot be closed to operating aircraft to permit the Contractor's operations on a continuous basis and will therefore be closed to aircraft operations intermittently as follows: See plans and Construction Safety Phasing Plan (CSPP) for closure requirements.

Contractor shall be required to conform to safety standards contained in AC 150/5370-2, Operational Safety on Airports During Construction (see Special Provisions).

80-04.1 Operational safety on airport during construction. All Contractors' operations shall be conducted in accordance with the project Construction Safety and Phasing Plan (CSPP) and the provisions set forth within the current version of AC 150/5370-2. 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 Safety Plan Compliance Document 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 that they implement and maintain all necessary measures.

No deviation or modifications may be made to the approved CSPP unless approved in writing by the Owner or Engineer.

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 Engineer, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer, be removed forthwith by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without approval of the Engineer.

Should the Contractor fail to remove such persons or person, or fail to furnish suitable and sufficient personnel for the proper execution of the work, the Engineer 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 be such that no injury to previously completed work, adjacent property, or existing airport facilities will result from 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 others are authorized by the Engineer. 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 Engineer 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 Engineer 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 Engineer 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 subsection.

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 as the Owner may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for the execution of the work, or for such time as is 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 Engineer's order to suspend work to the effective date of the Engineer's order to resume the work. Claims for such compensation shall be filed with the Engineer within the time period stated in the Engineer's order to resume work. The Contractor shall submit with his or her claim information substantiating the amount shown on the claim. The Engineer 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, for suspensions made at the request of the Owner, or for any other delay provided for in the contract, plans, or specifications.

If it should become 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 or working days allowed for completion of the work shall be stated in the proposal and contract and shall be known as the CONTRACT TIME.

Should the contract time require extension for reasons beyond the Contractor's control, it shall be adjusted as follows:

a. CONTRACT TIME based on WORKING DAYS shall be calculated weekly by the Engineer. The Engineer will furnish the Contractor a copy of his or her weekly statement of the number of working days charged against the contract time during the week and the number of working days currently specified for completion of the contract (the original contract time plus the number of working days, if any, that have been included in approved CHANGE ORDERS or SUPPLEMENTAL AGREEMENTS covering EXTRA WORK).

The Engineer shall base his or her weekly statement of contract time charged on the following considerations:

(1) No time shall be charged for days on which the Contractor is unable to proceed with the principal item of work under construction at the time for at least six (6) hours with the normal work force

employed on such principal item. Should the normal work force be on a double-shift, 12 hours shall be used. Should the normal work force be on a triple-shift, 18 hours shall apply. Conditions beyond the Contractor's control such as strikes, lockouts, unusual delays in transportation, temporary suspension of the principal item of work under construction or temporary suspension of the entire work which have been ordered by the Owner for reasons not the fault of the Contractor, shall not be charged against the contract time.

(2) The Engineer will not make charges against the contract time prior to the effective date of the notice to proceed.

(3) The Engineer will begin charges against the contract time on the first working day after the effective date of the notice to proceed.

(4) The Engineer will not make charges against the contract time after the date of final acceptance as defined in the subsection 50-15 titled FINAL ACCEPTANCE of Section 50.

(5) The Contractor will be allowed one (1) week in which to file a written protest setting forth his or her objections to the Engineer's weekly statement. If no objection is filed within such specified time, the weekly statement shall be considered as acceptable to the Contractor.

The contract time (stated in the proposal) is based on the originally estimated quantities as described in the subsection 20-05 titled INTERPRETATION OF ESTIMATED PROPOSAL QUANTITIES of Section 20. Should the satisfactory completion of the contract require performance of work in greater quantities than those estimated in the proposal, 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 contract time shall not consider either the cost of work or the extension of contract time that has been covered by change order or supplemental agreement and shall be made at the time of final payment.

b. 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.

c. When the contract time is a specified completion date, it shall be the date on which all contract work shall be substantially complete.

If the Contractor finds it impossible for reasons beyond his or her control to complete the work within the contract time as specified, or as extended in accordance with the provisions of this subsection, the Contractor may, at any time prior to the expiration of the contract time as extended, make a written request to the Owner for an extension of time setting forth the reasons which the Contractor believes will justify the granting of his or her request. Requests for extension of time on calendar day projects, caused by inclement weather, shall be supported with National Weather Bureau data showing the actual amount of inclement weather exceeded what could normally be expected during the contract period. The Contractor's plea that insufficient time was specified is not a valid reason for extension of time. If the supporting documentation justify the work was delayed because of conditions beyond the control and without the fault of the Contractor, the Owner may extend the time for completion by a change order that adjusts the contract time or completion date. The extended time for completion shall then be in full force and effect, the same as though it were the original time for completion.

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 the subsection 80-07 titled DETERMINATION AND EXTENSION OF CONTRACT TIME of this Section) the sum specified in the contract and proposal as liquidated damages will be deducted from any money due or to become due the Contractor or his or her 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.

Schedule	Liquidated Damages Cost	Allowed Construction Time
See Article 5 of the Agreement		

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 his or her 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 Engineer consider the Contractor in default of the contract for any reason above, the Engineer 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 Engineer 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 Engineer 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 Engineer.

Termination of the contract or a portion thereof shall neither relieve the Contractor of his or her responsibilities for the completed work nor shall it relieve his or her 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 Engineer 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 his or her work in such a manner as to ensure safety and a minimum of hindrance to flight operations. All Contractor equipment and material stockpiles shall be stored a minimum of 250 feet from the centerline of an active runway. No equipment will be allowed to park within the approach area of an active runway at any time. No equipment shall be within 250 feet of an active runway at any time.

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 Engineer, or his or her authorized representatives, using United States Customary Units of Measurement or the International System of Units.

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 Engineer.

Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.

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.

In computing volumes of excavation the average end area method or other acceptable methods will be used.

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.

The term "ton" will mean the short ton consisting of 2,000 lb (907 kg) avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, approved scales by competent, qualified personnel at locations designed by the Engineer. 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 Engineer directs, and each truck shall bear a plainly legible identification mark.

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.

When requested by the Contractor and approved by the Engineer 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 Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

Bituminous 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 or ASTM D633 for tars.

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 bituminous material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work.

When bituminous materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, may be used for computing quantities.

Cement will be measured by the ton (kg) or hundredweight (km).

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.

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.

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 by the Engineer in connection with force account work will be measured as agreed in the change order or supplemental agreement authorizing such force account work as provided in the subsection 90-05 titled PAYMENT FOR EXTRA WORK of this section.

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.

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.

Scales shall be accurate within 1/2% of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the inspector before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed one-tenth of 1% of the nominal rated capacity of the scale, but not less than 1 pound (454 grams). The use of spring balances will not be permitted.

Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the inspector can safely and conveniently view them.

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.

Scales must be tested for accuracy and serviced before use at a new site. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end.

Scales “overweighing” (indicating more than correct weight) will not be permitted to operate, and all materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of one-half of 1%.

In the event inspection reveals the scales have been underweighing (indicating less than correct weight), they shall be adjusted, and no additional payment to the Contractor will be allowed for materials previously weighed and recorded.

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.

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 Engineer. 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.

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 the subsection 70-18 titled NO WAIVER OF LEGAL RIGHTS of Section 70.

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 the subsection 40-02 titled ALTERATION OF WORK AND QUANTITIES of Section 40 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 his or her unbalanced allocation of overhead and profit among the contract items, or from any other cause.

90-04 Payment for omitted items. As specified in the subsection 40-03 titled OMITTED ITEMS of Section 40, the Engineer 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 Engineer 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 Engineer’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 Engineer’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 Engineer’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 the subsection 40-04 titled EXTRA WORK of Section 40, 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 Engineer, 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 the subsection 90-07 titled PAYMENT FOR MATERIALS ON HAND of this section. No partial payment will be made when the amount due to the Contractor since the last estimate amounts to less than five hundred dollars.

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. The Owner must ensure prompt and full payment of retainage from 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.

From the total of the amount determined to be payable on a partial payment, 10 percent of such total amount will be deducted and retained by the Owner until the final payment is made, except as may be provided (at the Contractor's option) in the subsection 90-08 titled PAYMENT OF WITHHELD FUNDS of this section. The balance 90 percent of the amount payable, less all previous payments, shall be certified for payment. Should the Contractor exercise his or her option, as provided in the subsection 90-08 titled PAYMENT OF WITHHELD FUNDS of this section, no such percent retainage shall be deducted.

When at least 95% of the work has been completed, the Engineer 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 Engineer 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 the subsection 90-09 titled ACCEPTANCE AND FINAL PAYMENT of this section.

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 Engineer at or on an approved site.
- b. The Contractor has furnished the Engineer with acceptable evidence of the quantity and quality of such stored or stockpiled materials.

c. The Contractor has furnished the Engineer 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 so stored or stockpiled.

e. The Contractor has furnished the Owner evidence that the material so 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 his or her 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 subsection.

90-08 Payment of withheld funds. At the Contractor's option, if an Owner withholds retainage in accordance with the methods described in subsection 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 the subsection 50-15 titled FINAL ACCEPTANCE of Section 50, the Engineer will prepare the final estimate of the items of work actually performed. The Contractor shall approve the Engineer's final estimate or advise the Engineer 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 Engineer 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 Engineer's final estimate. If, after such 30-day period, a dispute still exists, the Contractor may approve the Engineer'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 the subsection 50-16 titled CLAIMS FOR ADJUSTMENT AND DISPUTES of Section 50.

After the Contractor has approved, or approved under protest, the Engineer's final estimate, and after the Engineer's receipt of the project closeout documentation required in subsection 90-11 Project Closeout, 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 the subsection 50-16 titled CLAIMS FOR ADJUSTMENTS AND DISPUTES of Section 50 or under the provisions of this

subsection, 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. 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.

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:

(1) The Contractor's failure to conform to contract requirements; or

(2) 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 Project closeout. 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 Engineer 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 subsection 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.
- k.** Security for Construction Warranty.
- l.** Equipment commissioning documentation submitted, if required.

END OF SECTION 90

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Section 100 Contractor Quality Control Program

100-01 General. When the specification requires a Contractor Quality Control Program, the Contractor shall establish, provide, and maintain an effective Quality Control Program that details the methods and procedures that will be taken to assure that all materials and completed construction required by this contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified here and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.

The intent of this section is to enable the Contractor to establish a necessary level of control that will:

- a. Adequately provide for the production of acceptable quality materials.
- b. Provide sufficient information to assure both the Contractor and the Engineer that the specification requirements can be met.
- c. Allow the Contractor as much latitude as possible to develop his or her own standard of control.

The Contractor shall be prepared to discuss and present, at the preconstruction conference, their understanding of the quality control requirements. The Contractor shall not begin any construction or production of materials to be incorporated into the completed work until the Quality Control Program has been reviewed and accepted by the Engineer. No partial payment will be made for materials subject to specific quality control requirements until the Quality Control Program has been reviewed.

The quality control requirements contained in this section and elsewhere in the contract technical specifications are in addition to and separate from the acceptance testing requirements. Acceptance testing requirements are the responsibility of the Engineer.

Paving projects over \$500,000 shall have a Quality Control (QC)/Quality Assurance (QA) workshop with the Engineer, Contractor, subcontractors, testing laboratories, and Owner's representative at start of construction. The workshop shall address QC and QA requirements of the project specifications. The Contractor shall coordinate with the Airport and the Engineer on time and location of the QC/QA workshop.

100-02 Description of program.

a. General description. The Contractor shall establish a Quality Control Program to perform quality control inspection and testing of all items of work required by the technical specifications, including those performed by subcontractors. This Quality Control Program shall ensure conformance to applicable specifications and plans with respect to materials, workmanship, construction, finish, and functional performance. The Quality Control Program shall be effective for control of all construction work performed under this Contract and shall specifically include surveillance and tests required by the technical specifications, in addition to other requirements of this section and any other activities deemed necessary by the Contractor to establish an effective level of quality control.

b. Quality Control Program. The Contractor shall describe the Quality Control Program in a written document that shall be reviewed and approved by the Engineer prior to the start of any production, construction, or off-site fabrication. The written Quality Control Program shall be submitted to the Engineer for review and approval at least 5 calendar days before the Preconstruction Meeting. The

Contractor's Quality Control Plan and Quality Control testing laboratory must be approved in writing by the Engineer prior to the Notice to Proceed (NTP).

The Quality Control Program shall be organized to address, as a minimum, the following items:

- a. Quality control organization
- b. Project progress schedule
- c. Submittals schedule
- d. Inspection requirements
- e. Quality control testing plan
- f. Documentation of quality control activities
- g. Requirements for corrective action when quality control and/or acceptance criteria are not met

The Contractor is encouraged to add any additional elements to the Quality Control Program that is deemed necessary to adequately control all production and/or construction processes required by this contract.

100-03 Quality control organization. The Contractor Quality Control Program shall be implemented by the establishment of a separate quality control organization. An organizational chart shall be developed to show all quality control personnel and how these personnel integrate with other management/production and construction functions and personnel.

The organizational chart shall identify all quality control staff by name and function, and shall indicate the total staff required to implement all elements of the Quality Control Program, including inspection and testing for each item of work. If necessary, different technicians can be used for specific inspection and testing functions for different items of work. If an outside organization or independent testing laboratory is used for implementation of all or part of the Quality Control Program, the personnel assigned shall be subject to the qualification requirements of paragraph 100-03a and 100-03b. The organizational chart shall indicate which personnel are Contractor employees and which are provided by an outside organization.

The quality control organization shall, as a minimum, consist of the following personnel:

a. Program Administrator. The Program Administrator shall be a full-time [on-site] employee of the Contractor, or a consultant engaged by the Contractor. The Program Administrator shall have a minimum of five (5) years of experience in airport and/or highway construction and shall have had prior quality control experience on a project of comparable size and scope as the contract.

Additional qualifications for the Program Administrator shall include at least one of the following requirements:

- (1) Professional Engineer with one (1) year of airport paving experience.
- (2) Engineer-in-training with two (2) years of airport paving experience.
- (3) An individual with three (3) years of highway and/or airport paving experience, with a Bachelor of Science Degree in Civil Engineering, Civil Engineering Technology or Construction.
- (4) Construction materials technician certified at Level III by the National Institute for Certification in Engineering Technologies (NICET).
- (5) Highway materials technician certified at Level III by NICET.
- (6) Highway construction technician certified at Level III by NICET.

(7) A NICET certified engineering technician in Civil Engineering Technology with five (5) years of highway and/or airport paving experience.

The Program Administrator shall have full authority to institute any and all actions necessary for the successful implementation of the Quality Control Program to ensure compliance with the contract plans and technical specifications. The Program Administrator shall report directly to a responsible officer of the construction firm. The Program Administrator may supervise the Quality Control Program on more than one project provided that person can be at the job site within two (2) hours after being notified of a problem.

b. Quality control technicians. A sufficient number of quality control technicians necessary to adequately implement the Quality Control Program shall be provided. These personnel shall be either Engineers, engineering technicians, or experienced craftsman with qualifications in the appropriate field equivalent to NICET Level II or higher construction materials technician or highway construction technician and shall have a minimum of two (2) years of experience in their area of expertise.

The quality control technicians shall report directly to the Program Administrator and shall perform the following functions:

(1) Inspection of all materials, construction, plant, and equipment for conformance to the technical specifications, and as required by subsection 100-06.

(2) Performance of all quality control tests as required by the technical specifications and subsection 100-07.

(3) Performance of density tests for the Engineer when required by the technical specifications.

Certification at an equivalent level, by a state or nationally recognized organization will be acceptable in lieu of NICET certification.

c. Staffing levels. The Contractor shall provide sufficient qualified quality control personnel to monitor each work activity at all times. Where material is being produced in a plant for incorporation into the work, separate plant and field technicians shall be provided at each plant and field placement location. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity. The Quality Control Program shall state where different technicians will be required for different work elements.

100-04 Project progress schedule. The Contractor shall submit a coordinated construction schedule for all work activities. The 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 in the contract. As a minimum, it shall provide information on the sequence of work activities, milestone dates, and activity duration.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a twice 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.

100-05 Submittals schedule. The Contractor shall submit a detailed listing of all submittals (for example, mix designs, material certifications) and shop drawings required by the technical specifications. The listing can be developed in a spreadsheet format and shall include:

- a. Specification item number
- b. Item description
- c. Description of submittal
- d. Specification paragraph requiring submittal

e. Scheduled date of submittal

100-06 Inspection requirements. Quality control inspection functions shall be organized to provide inspections for all definable features of work, as detailed below. All inspections shall be documented by the Contractor as specified by subsection 100-07.

Inspections shall be performed daily to ensure continuing compliance with contract requirements until completion of the particular feature of work. These shall include the following minimum requirements:

a. During plant operation for material production, quality control test results and periodic inspections shall be used to ensure the quality of aggregates and other mix components, and to adjust and control mix proportioning to meet the approved mix design and other requirements of the technical specifications. All equipment used in proportioning and mixing shall be inspected to ensure its proper operating condition. The Quality Control Program shall detail how these and other quality control functions will be accomplished and used.

b. During field operations, quality control test results and periodic inspections shall be used to ensure the quality of all materials and workmanship. All equipment used in placing, finishing, and compacting shall be inspected to ensure its proper operating condition and to ensure that all such operations are in conformance to the technical specifications and are within the plan dimensions, lines, grades, and tolerances specified. The Program shall document how these and other quality control functions will be accomplished and used.

100-07 Quality control testing plan. As a part of the overall Quality Control Program, the Contractor shall implement a quality control testing plan, as required by the technical specifications. The testing plan shall include the minimum tests and test frequencies required by each technical specification Item, as well as any additional quality control tests that the Contractor deems necessary to adequately control production and/or construction processes.

The testing plan can be developed in a spreadsheet fashion and shall, as a minimum, include the following:

- a. Specification item number (for example, P-401)
- b. Item description (for example, Plant Mix Bituminous Pavements)
- c. Test type (for example, gradation, grade, asphalt content)
- d. Test standard (for example, ASTM or American Association of State Highway and Transportation Officials (AASHTO) test number, as applicable)
- e. Test frequency (for example, as required by technical specifications or minimum frequency when requirements are not stated)
- f. Responsibility (for example, plant technician)
- g. Control requirements (for example, target, permissible deviations)

The testing plan shall contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D3665. The Engineer shall be provided the opportunity to witness quality control sampling and testing.

All quality control test results shall be documented by the Contractor as required by subsection 100-08.

100-08 Documentation. The Contractor shall maintain current quality control records of all inspections and tests performed. These records shall include factual evidence that the required inspections or tests have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviations, causes for rejection, etc.; proposed remedial action; and corrective actions taken.

These records must cover both conforming and defective or deficient features, and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the Engineer daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the Contractor's Program Administrator.

Specific Contractor quality control records required for the contract shall include, but are not necessarily limited to, the following records:

a. Daily inspection reports. Each Contractor quality control technician shall maintain a daily log of all inspections performed for both Contractor and subcontractor operations. These technician's daily reports shall provide factual evidence that continuous quality control inspections have been performed and shall, as a minimum, include the following:

- (1) Technical specification item number and description
- (2) Compliance with approved submittals
- (3) Proper storage of materials and equipment
- (4) Proper operation of all equipment
- (5) Adherence to plans and technical specifications
- (6) Review of quality control tests
- (7) Safety inspection.

The daily inspection reports shall identify inspections conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.

The daily inspection reports shall be signed by the responsible quality control technician and the Program Administrator. The Engineer shall be provided at least one copy of each daily inspection report on the work day following the day of record.

b. Daily test reports. The Contractor shall be responsible for establishing a system that will record all quality control test results. Daily test reports shall document the following information:

- (1) Technical specification item number and description
- (2) Test designation
- (3) Location
- (4) Date of test
- (5) Control requirements
- (6) Test results
- (7) Causes for rejection
- (8) Recommended remedial actions
- (9) Retests

Test results from each day's work period shall be submitted to the Engineer prior to the start of the next day's work period. When required by the technical specifications, the Contractor shall maintain statistical quality control charts. The daily test reports shall be signed by the responsible quality control technician and the Program Administrator.

100-09 Corrective action requirements. The Quality Control Program shall indicate the appropriate action to be taken when a process is deemed, or believed, to be out of control (out of tolerance) and detail what action will be taken to bring the process into control. The requirements for corrective action shall include both general requirements for operation of the Quality Control Program as a whole, and for individual items of work contained in the technical specifications.

The Quality Control Program shall detail how the results of quality control inspections and tests will be used for determining the need for corrective action and shall contain clear sets of rules to gauge when a process is out of control and the type of correction to be taken to regain process control.

When applicable or required by the technical specifications, the Contractor shall establish and use statistical quality control charts for individual quality control tests. The requirements for corrective action shall be linked to the control charts.

100-10 Surveillance by the Engineer. All items of material and equipment shall be subject to surveillance by the Engineer at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate quality control system in conformance with the requirements detailed here and the applicable technical specifications and plans. In addition, all items of materials, equipment and work in place shall be subject to surveillance by the Engineer at the site for the same purpose.

Surveillance by the Engineer does not relieve the Contractor of performing quality control inspections of either on-site or off-site Contractor's or subcontractor's work.

100-11 Noncompliance.

a. The Engineer will notify the Contractor of any noncompliance with any of the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Any notice, when delivered by the Engineer or his or her authorized representative to the Contractor or his or her authorized representative at the site of the work, shall be considered sufficient notice.

b. In cases where quality control activities do not comply with either the Contractor Quality Control Program or the contract provisions, or where the Contractor fails to properly operate and maintain an effective Quality Control Program, as determined by the Engineer, the Engineer may:

- (1) Order the Contractor to replace ineffective or unqualified quality control personnel or subcontractors.
- (2) Order the Contractor to stop operations until appropriate corrective actions are taken.

END OF SECTION 100

ATTACHMENT 1

GUIDELINES FOR CONTRACT

PROVISIONS FOR OBLIGATED

SPONSORS AND AIRPORT

IMPROVEMENT PROGRAM PROJECTS

GUIDELINES FOR CONTRACT PROVISIONS FOR OBLIGATED SPONSORS AND AIRPORT IMPROVEMENT PROGRAM PROJECTS

Issued on June 19, 2018

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.

**NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION to
ENSURE EQUAL EMPLOYMENT OPPORTUNITY**

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 each trade: **2.8%**

Goals for female participation in each trade: **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 **Pennsylvania, Erie County, Erie.**

BREACH OF CONTRACT TERMS

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.

GENERAL CIVIL RIGHTS PROVISIONS

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.

Title VI Solicitation Notice:

The **Erie Regional Airport Authority**, 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.

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.

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).

CLEAN AIR AND WATER POLLUTION CONTROL

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.

CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS

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.

COPELAND “ANTI-KICKBACK” ACT

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.

DAVIS-BACON REQUIREMENTS

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 assets 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 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.

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.

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.

DISADVANTAGED BUSINESS ENTERPRISE

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.

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.

Solicitation Language (Race/Gender Neutral Means)

The requirements of 49 CFR part 26 apply to this contract. It is the policy of **Erie Regional Airport Authority** 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.

Prime Contracts (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 Erie Regional Airport Authority. 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 Erie Regional Airport Authority. This clause applies to both DBE and non-DBE subcontractors.

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.

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*).

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.

**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).

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.

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.

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.

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 (20 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.

PROCUREMENT OF RECOVERED MATERIALS

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.

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.

TERMINATION FOR CONVENIENCE (CONSTRUCTION & EQUIPMENT CONTRACTS)

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.

TERMINATION 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.

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.

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.

ATTACHMENT 2

DAVIS BACON WAGE RATES

General Decision Number: PA190088 02/15/2019 PA88

Superseded General Decision Number: PA20180112

State: Pennsylvania

Construction Type: Building

County: Erie County in Pennsylvania.

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.

Modification Number	Publication Date
0	01/04/2019
1	01/11/2019
2	02/01/2019
3	02/15/2019

BOIL0154-007 01/01/2017

	Rates	Fringes
BOILERMAKER.....	\$ 40.90	27.27

BRPA0009-011 12/01/2018

	Rates	Fringes
TILE FINISHER.....	\$ 25.59	15.12
TILE SETTER.....	\$ 31.30	19.42

BRPA0009-056 11/01/2018

	Rates	Fringes
BRICKLAYER (Including Pointing, Caulking, and		

Cleaning).....	\$ 28.07	20.59
MASON - STONE.....	\$ 28.07	20.59

CARP0081-010 05/01/2018

	Rates	Fringes
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CARPENTER (Includes Drywall Hanging, Metal Stud Installation, Floor Laying-Carpet, Vinyl, and Form Work; Excludes Acoustical Ceiling Installation).....	\$ 29.74	15.23
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CARP0142-012 06/01/2018

	Rates	Fringes
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CARPENTER (Acoustical Ceiling Installation Only).....	\$ 33.75	17.03
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CARP2235-007 01/01/2019

	Rates	Fringes
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PILEDRIVERMAN.....	\$ 34.30	19.30
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CARP2235-010 06/01/2018

	Rates	Fringes
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MILLWRIGHT.....	\$ 40.34	19.16
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ELEC0056-006 06/05/2017

	Rates	Fringes
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ELECTRICIAN (Excludes Low Voltage Wiring and Alarm Installation).....	\$ 32.43	3%+22.65
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ELEC0712-011 01/01/2018

	Rates	Fringes
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ELECTRICIAN (Alarm Installation and Low Voltage Wiring Only).....	\$ 37.55	22.95
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* ENGI0066-043 06/18/2018

	Rates	Fringes
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POWER EQUIPMENT OPERATOR Backhoe/Excavator/Trackhoe, Bobcat/Skid Steer/Skid Loader,Crane*, Drill Rig Caissons, Highlift, Paver (Asphalt, Aggregate, and Concrete).....	\$ 29.85	17.12
Bulldozer, Compactor, Drill, Gradall, Grader/Blade, Mechanic, Forklift (Lull).....	\$ 29.85	17.12

Hoist, Pump, Forklift (ridden or self-propelled)...	\$ 29.18	17.12
Loader.....	\$ 29.85	17.12
Oiler.....	\$ 25.40	17.12
Roller.....	\$ 29.18	17.12

*Add to Crane rate:

- Booms 101-150 jibs- Add \$0.29
- Booms 151-200 jibs- Add \$0.56
- Booms over 200 jibs- Add \$0.84

IRON0003-023 06/01/2018

	Rates	Fringes
IRONWORKER (Ornamental, Reinforcing, Rigger and Structural; Metal Buildings: Metal Siding/Wall Panels Installation).....	\$ 29.95	28.59

LAB00125-005 06/01/2014

	Rates	Fringes
LABORER Mason Tender - Cement/Concrete.....	\$ 24.34	9.75

LAB00323-005 01/01/2014

	Rates	Fringes
LABORER Mason Tender-Brick.....	\$ 21.92	12.81

PAIN0549-002 05/01/2017

	Rates	Fringes
PAINTER Brush and Roller.....	\$ 21.87	17.22
Drywall Finishing/Taping....	\$ 22.12	17.22
Spray.....	\$ 22.62	17.22

PLAS0526-013 05/01/2015

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 25.56	15.42

PLUM0027-006 06/01/2017

	Rates	Fringes
PLUMBER.....	\$ 39.95	20.52

PLUM0449-006 06/01/2018

	Rates	Fringes
PIPEFITTER (Includes HVAC Pipe Installation).....	\$ 40.55	22.27

ROOF0210-007 05/01/2018

	Rates	Fringes
ROOFER (Excludes Metal Roof Installation and Waterproofing).....	\$ 28.75	15.29

SFPA0669-004 01/01/2019

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers).....	\$ 38.80	23.04

SHEE0012-013 07/01/2018

	Rates	Fringes
SHEET METAL WORKER (Includes HVAC Duct, Metal Roof, and Metal Flashing Installation).....	\$ 34.47	27.54

* UAVG-PA-0024 01/01/2019

	Rates	Fringes
GLAZIER.....	\$ 26.30	21.24

* UAVG-PA-0025 01/01/2016

	Rates	Fringes
PLASTERER.....	\$ 25.51	13.91

SUPA2011-046 08/20/2014

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR - MECHANICAL (Duct, Pipe & Mechanical System Insulation).....	\$ 30.41	20.04
LABORER: Common or General.....	\$ 17.40	6.93
ROOFER: Waterproofing Only.....	\$ 26.77	12.57
TRUCK DRIVER: Dump Truck.....	\$ 23.36	7.60

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.

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)).

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.

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

General Decision Number: PA190002 02/15/2019 PA2

Superseded General Decision Number: PA20180004

State: Pennsylvania

Construction Types: Heavy and Highway

Counties: Allegheny, Armstrong, Beaver, Bedford, Blair, Butler, Cambria, Cameron, Centre, Clarion, Clearfield, Clinton, Crawford, Elk, Erie, Fayette, Forest, Franklin, Fulton, Greene, Huntingdon, Indiana, Jefferson, Lawrence, McKean, Mercer, Mifflin, Potter, Somerset, Venango, Warren, Washington and Westmoreland Counties in Pennsylvania.

HEAVY AND HIGHWAY CONSTRUCTION PROJECTS (excluding sewer grouting projects and excluding sewage and water treatment plant projects)

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.

Modification Number	Publication Date
0	01/04/2019
1	01/11/2019
2	02/15/2019

BOIL0013-005 03/01/2018

CENTRE, FRANKLIN, POTTER, CLINTON, FULTON, HUNTINDON AND MIFFLIN COUNTIES

	Rates	Fringes
BOILERMAKER.....	\$ 45.89	33.39

BOIL0154-004 01/01/2017

ALLEGHENY, ARMSTRONG, BEAVER, BEDFORD, BLAIR, BUTLER, CAMBRIA,

CAMERON, CLARION, CLEARFIELD, CRAWFORD, ELK, FAYETTE, FOREST, GREENE, INDIANA, JEFFERSON, LAWRENCE, MCKEAN, MERCER, SOMERSET, VENANGO, WARREN, WASHINGTON AND WESTMORELAND COUNTIES

	Rates	Fringes
BOILERMAKER.....	\$ 40.90	27.27

BOIL0744-003 07/01/2008		

ERIE COUNTY

	Rates	Fringes
BOILERMAKER.....	\$ 35.34	18.48

* BRPA0005-033 05/01/2018		

MIFFLIN COUNTY

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 31.36	17.73

BRPA0005-046 05/01/2016		

FRANKLIN COUNTY

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 32.21	14.18

* BRPA0005-071 05/01/2018		

CLINTON COUNTY

	Rates	Fringes
BRICKLAYER.....	\$ 33.16	16.31

BRPA0009-004 12/01/2018		

BEDFORD, BLAIR, CAMBRIA, CENTRE COUNTY (Halfmoon, Houston, Patton, Rush, Taylor and Worth Townships), FULTON, HUNTINGDON, and SOMERSET COUNTIES

	Rates	Fringes
Bricklayer, Stonemason & Marble Setter.....	\$ 29.46	19.58

BRPA0009-006 12/01/2018		

CLEARFIELD, FOREST, JEFFERSON, VENANGO, AND CLARION (Except Brady, Madison, Perry, Porter, Redbank, and Toby Townships) COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	\$ 29.90	19.91
Marble mason.....	\$ 29.90	19.91

BRPA0009-023 06/01/2018

BEAVER COUNTY

	Rates	Fringes
BRICKLAYER.....	\$ 30.16	21.41

BRPA0009-025 12/01/2018

BUTLER, LAWRENCE, AND MERCER COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 30.11	21.64

BRPA0009-032 06/01/2017

FAYETTE (Jefferson & Washington Twps), GREENE (Except Cumberland, Dunkirk, Greene, Monongahelia Twps), INDIANA, AND WESTMORELAND (Rostraver Twp) COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 31.00	20.66

BRPA0009-033 12/01/2018

ARMSTRONG, CLARION (Brady, Madison, Perry, Tobe, Porter, Redbank Twps), FAYETTE (Except Jefferson & Washington Twps), GREENE (Cumberland, Dunkirk, Greene, Monongahelia Twps), INDIANA, AND WESTMORELAND (Except Rostrave Twp) COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 31.95	21.96

BRPA0009-034 11/01/2017

ERIE COUNTY

	Rates	Fringes
BRICKLAYER.....	\$ 27.55	19.76

BRPA0009-058 12/01/2017

ALLEGHENY, WASHINGTON (Cross Creek, Hanover, Jefferson, Mt Pleasant, Nottingham, Peters, Robinson, Smith, Union Twps) COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 31.69	21.27

BRPA0009-059 12/01/2018

CAMERON, ELK, McKEAN, POTTER AND WARREN COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 27.66	19.67

CARP2235-005 01/01/2019

	Rates	Fringes
PILEDRIVERMAN		
Piledriverman (welder).....	\$ 35.25	19.30
Piledriverman.....	\$ 34.30	19.30

CARP2235-006 01/01/2019

	Rates	Fringes
Diver.....	\$ 51.45	19.30
Tender.....	\$ 34.30	19.30

CARP2274-001 01/01/2019

	Rates	Fringes
CARPENTER (ALLEGHENY, ARMSTRONG, BEAVER, BUTLER, ERIE, FAYETTE, GREENE, LAWRENCE, MERCER, WASHINGTON, AND WESTMORELAND COUNTIES)		
Carpenters (Welders).....	\$ 34.97	18.42
Carpenters.....	\$ 34.02	18.42
CARPENTER (BEDFORD, BLAIR, CAMBRIA, CAMERON, CENTRE, CLARION, CLINTON, CLEARFIELD, CRAWFORD, ELK, FOREST, FRANKLIN, FULTON, HUNTINGDON, INDIANA, JEFFERSON, MCKEAN, MIFFLIN, POTTER, SOMERSET, VENANGO, AND WARREN COUNTIES)		
Carpenters (Welders).....	\$ 34.72	18.42
Carpenters.....	\$ 33.77	18.42

ELEC0005-006 12/21/2018

ALLEGHENY, ARMSTRONG, BEDFORD, BLAIR, BUTLER CAMBRIA, CAMERON,
CENTRE (Remainder), CLARION, CLEARFIELD, ELK, FAYETTE, FULTON,
GREENE, HUNTINGDON, INDIANA, JEFFERSON, MCKEAN, SOMERSET,
VENANGO, WASHINGTON, AND WESTMORELAND COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 40.76	26.34

ELEC0056-004 06/05/2017

ERIE, FOREST AND WARREN COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 32.43	3%+22.65

ELEC0126-005 05/28/2018

ALLEGHENY, ARMSTRONG, BEAVER, BEDFORD, BLAIR, CAMBRIA, CENTRE,
CLARION, CLEARFIELD, FAYETTE, FULTON, GREENE, HUNTINGDON,
INDIANA, JEFFERSON, SOMERSET, WASHINGTON AND WESTMORELAND

	Rates	Fringes
Line Construction:		
Cable Splicer.....	\$ 46.29	29.25%+11.25
Groundman.....	\$ 27.77	29.25%+11.25
Lineman.....	\$ 46.29	29.25%+11.25
Truck Driver.....	\$ 30.09	29.25%+11.25
Winch Truck Operator.....	\$ 32.40	29.25%+11.25

ELEC0126-007 05/28/2018

FRANKLIN AND MIFFLIN COUNTIES

	Rates	Fringes
Line Construction:		
Cable Splicer.....	\$ 45.25	29.25%+11.25
Groundman.....	\$ 27.15	29.25%+11.25
Lineman.....	\$ 45.25	29.25%+11.25
Truck Driver.....	\$ 29.41	29.25%+11.25
Winch Truck Operator.....	\$ 31.68	29.25%+11.25

ELEC0143-007 06/01/2018

FRANKLIN and MIFFLIN COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 30.60	23.34

ELEC0712-003 01/01/2018

CRAWFORD, BEAVER, LAWRENCE AND MERCER COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 37.55	22.95

ELEC0812-008 06/01/2017

CLINTON COUNTY

	Rates	Fringes
ELECTRICIAN.....	\$ 33.59	18.61

ELEC0812-009 06/01/2017

POTTER COUNTY

	Rates	Fringes
ELECTRICIAN.....	\$ 34.60	18.64

ELEC0812-011 06/01/2017

CENTRE COUNTY (Burnside, Curtin, Liberty, Howard, Marion, Walker, Miles, Haines Townships)

	Rates	Fringes
ELECTRICIAN.....	\$ 33.59	18.61

ELEC1319-004 09/02/2018

BUTLER, CAMERON, CLINTON, CRAWFORD, ELK, ERIE, FOREST,
LAWRENCE, MCKEAN, MERCER, VENANGO, WARREN AND POTTER COUNTIES

	Rates	Fringes
Line Construction:		
Equipment Operator.....	\$ 56.43	19.84
Groundmen.....	\$ 34.99	11.28
Linemen.....	\$ 56.43	22.84
Truck Driver.....	\$ 36.68	11.41

ENGI0066-016 01/01/2019		

	Rates	Fringes
Power equipment operators: (ALLEGHENY, ARMSTRONG, BEAVER, BLAIR, BUTLER, CAMBRIA, CENTRE, CLARION, CLEARFIELD, CRAWFORD, ERIE, ELK, FAYETTE, GREENE, INDIANA, JEFFERSON, LAWRENCE, MCKEAN, MERCER, SOMERSET, VENANGO, WARREN, WASHINGTON, AND WESTMORELAND COUNTIES)		
GROUP 1.....	\$ 31.89	21.68
GROUP 2.....	\$ 31.63	21.68
GROUP 3.....	\$ 27.98	21.68
GROUP 4.....	\$ 27.52	21.68
GROUP 5.....	\$ 27.27	21.68
Power equipment operators: (BEDFORD, CAMERON, CLINTON, FOREST, FRANKLIN, FULTON, HUNTINGDON, MIFFLIN, AND POTTER COUNTIES)		
GROUP 1.....	\$ 31.60	21.68
GROUP 2.....	\$ 31.32	21.68
GROUP 3.....	\$ 27.68	21.68
GROUP 4.....	\$ 27.19	21.68
GROUP 5.....	\$ 26.98	21.68

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1 - Asphalt Paving Machine (Spreader), Autograde (C.M.I. and similar); Backfiller, Compactor with Blade, Backhoe - 360 and 180 degree Swing; Cableway; Caisson Drill (similar to Hugh Williams), Central Mix Plant; Cooling Plant; Concrete Paving Mixer, Concrete Pump (self-propelled); Cranes; Cranes (boom or mast over 101ft.\$50 per each additional 50 feet inclusive of jib), Cranes (Tower Stationary- Climbing Tower Crane); Derrick; Derrick Boat; Dozer(greater than 25,000 lbs.); Dragline; Dredge; Dredge Hydraulic; Elevating Grader; Franki Pile Machine; Gradall (remote control or otherwise),Grader (power-fine grade); Hllift (4 cy. and over); Hoist 2 Drums or more (in one unit); Hydraulic Boom Truck with pivotal cab (single motor-Pitman or similar), (Boom and Mast over 101 feet will be paid an additional 50 feet inclusive of jib if used); Kocal; Mechanic, Locomotive (std. Gauge); Metro-chip Harvester or similar; Milling Machine (Roto Mill or similar); Mix Mobile; Mix Mobile (with Self Loading Attachment), Mucking Machine (tunnel); Pile Driver Machine; Pipe Extrusion Machine; Presplitter Drill (self contained);

Refrigeration Plant (soil Stablization) Rough Terrain Crane (25 ton over) (Boom and Mast over 101 feet will be paid an additional 50 feet inclusive of jib if used); Rough Terrain Crane (under 25 ton), Scrapers; Shovel-Power; Slip form Paver (C.M.I. and similar); Trenching Machine (30,000 lbs. and over), Trenching Machine (under 30,000 lb.), Tunnell Machine (Mark XXI Jarva or similar), Vermeer Saw, Whirley, Mechanic, Compactor with blade

GROUP 2: Asphalt plant operator; auger (tractor mtd.); auger (truck mtd.); belt loader (euclid or similar); boring machine; cable placer or layer; Directional drill over 3,000 lbs thrust; concrete batch plant (electronically synchronized); concrete belt placer (C.M.I. and similar); concrete finishing machine and spreader, concrete mixer (over 1 cy.) concrete pump (stationary); core drill (truck or skid mtd. - similar to penn drill), dozer (25,000 lbs or less); Ditch Witch Saw, force feedloader; fork lift (lull or similar); grader - power; grease unit opertor (head); guard rail post driver (truck mounted) guard rail post driver (skid type); hilift (under 4 cy.); skid steer loader; hydraulic boom truck (non-pivotal cab); job work boat (powered), jumbo operator; locomotive (narrow guage); minor equipment operator (accumulative four units); mucking machine; multi-head saw (groover); overhead crane; roller -power- asphalt; ross carrier; side boom or tractor mounted boom; shuttle buggy (asphalt), stone crusher (screening-washing plants); stone spreader (self propelled) truck mounted drill (davey or similar); welder and repairman; well point pump operator; bidwell concrete finishing machine (or similar).

GROUP 3: Broom Finisher (C.M.I. or similar); Compactors/Rollers (static or vibratory (Self-propelled) on dirt or stone; Curb Builder; Minor Equipment Opertor (two or three units); Multi-head Tie Tamper; Pavement Breaker (self-propelled or ridden); Soil Stablizer Machine; Tire Repairman; Tractor (snaking and hauling); Well Driller and Horizontal: Winch or "A" Frame Truck (when hoisting and lowering).

GROUP 4: Ballast Regulator; Compressor; Concrete Mixer (1 cy. & under with skip); Concrete Saw (Ridden or selp-propelled); Conveyor; Elevator (Material hauling only); Fork-lift (Ridden or self-propelled); Form Line Machine; Generator; Groute Pump; Heater (Machinical); Hoist (single Drum); Ladavator, Light Plant; Mulching Machine; Personnel Boat (Powered), Pulverizer, Pumps, Seeding Machine, spray Cure Machine (powered Driven); Subgrader; Tie Puller; Tugger; Welding Machine (Gas or Diesel).

GROUP 5: Deck Hand; Farm Tractor; Fireman on Boiler; Oiler; Power Broom; Side Delivery Shoulder Spreader (attachment);

IRON003-001 06/01/2018

ALLEGHENY, FAYETTE, WESTMORELAND, CAMBRIA, INDIANA, ARMSTRONG, BUTLER, BEAVER, CLARION, AND WASHINGTON COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 34.49	30.71

IRON0003-007 06/01/2018

BLAIR, CAMERON, CENTRE, CLEARFIELD, CLINTON, ELK, JEFFERSON, MCKEAN, AND POTTER COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 28.97	28.65

IRON0003-011 06/01/2018

CRAWFORD, ERIE, FOREST, AND WARREN COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 29.95	28.59

IRON0207-002 06/01/2018

LAWRENCE, MERCER, AND VENANGO COUNTIES

	Rates	Fringes
IRONWORKER.....	\$ 28.92	24.90

IRON0404-008 07/01/2018

FRANKLIN (Remainder), HUNTINGDON (Remainder), AND MIFFLIN COUNTIES

	Rates	Fringes
IRONWORKER, STRUCTURAL.....	\$ 32.03	29.13

IRON0549-002 12/01/2012

GREENE COUNTY

	Rates	Fringes
IRONWORKER.....	\$ 30.45	16.04

IRON0568-004 05/01/2018

BEDFORD, FRANKLIN (Southwest 1/3), FULTON, HUNTINGDON (Western 2/3), AND SOMERSET COUNTIES

	Rates	Fringes
IRONWORKER Structural, Ornamental, Reinforcing, Machinery Mover, Rigger & Machinery Erector, Welder, Fence Erector.....	\$ 28.56	20.61

LAB01058-001 01/01/2019

	Rates	Fringes
LABORER (BEDFORD, CAMERON, CENTRE, CLINTON, CRAWFORD,		

FOREST, FRANKLIN, FULTON,
HUNTINGDON, JEFFERSON,
MIFFLIN, AND POTTER COUNTIES)

GROUP 1.....	\$ 25.35	23.25
GROUP 2.....	\$ 25.51	23.25
GROUP 3.....	\$ 26.00	23.25
GROUP 4.....	\$ 26.45	23.25
GROUP 5.....	\$ 26.86	23.25
GROUP 6.....	\$ 23.70	23.25
GROUP 7.....	\$ 26.35	23.25
GROUP 8.....	\$ 27.85	23.25

Laborers: (ALLEGHENY,
ARMSTRONG, BEAVER, BLAIR,
BUTLER, CAMBRIA, CLARION,
CLEARFIELD, ELK, ERIE,
FAYETTE, GREENE, INDIANA,
LAWRENCE, MCKEAN, MERCER,
SOMERSET, VENANGO, WARREN,
WASHINGTON, AND WESTMORELAND
COUNTIES)

GROUP 1.....	\$ 25.45	23.25
GROUP 2.....	\$ 25.61	23.25
GROUP 3.....	\$ 26.00	23.25
GROUP 4.....	\$ 26.45	23.25
GROUP 5.....	\$ 26.86	23.25
GROUP 6.....	\$ 23.70	23.25
GROUP 7.....	\$ 26.45	23.25
GROUP 8.....	\$ 27.95	23.25

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt curb sealer; Asphalt tamper; Batcherman (weigh) Blaster,Boatman, Brakeman, Change house attendant, Coffor dam, Concrete curing pitman, Puddler, Drill Runner's helper (Includes Drill Mounted on Truck, Track, or similar and Davey Drill Spots, Clean up, helps to maintain), Electric Brush and or Grinder, Fence Construction (Including Fence Machine Operator) Form stripper and Mover, Gabion (Erectors and Placers) Hydro jet blaster nozzleman; Landscape laborer, Manually moved emulusion sprayer, Radio actuated traffic control operator Rip rap work, scaffolds and Runways, Sheetters and Shorers (includes lagging) structural concrete Top Surfacers, Walk Behind Street Sweeper, and Wood Chipper; water boy

GROUP 2: Air tool operator (all types); Asphalt, batch & concrete plant operator (manually operated) Burner, Caisson; men (open air); Carryable pumps; Chain saw operator including attachments, Cribbing, (concrete or steel); Curb machine operator (asphalt or concrete walk behind); Diamond head Core Driller, Drill runner's helper (tunnel) Fork Lift, (walk behind), Form Setter (Road Forms Line man) Highway Slab reinforcement placers (including joint and Basket Setters) Hydraulic pipe pusher; Liner plates (Tile or Vitriified Clay) Mechanical compacting equipment operators, Mechanical joint sealer, Dope pot and Tar Kettle, Mortar mixer (hand or machine) Muckers, Brakemen & all other Labor, (Includes installation of utility lines) Pipe Layers /Fusion /Heating Iron (Regardless of materials) Portable Single Unit Conveyor, Post Hole Auger, (2 or 4 cycle hand operated) Power wheelbarrows and buggies, Rail porter or similar; Sand blaster;Signal Man,Vibrator operator, All RAILROAD TRACK WORK TO INCLUDE THE FOLLOWING: adzing machine, ballast Router, Bolting Machine, Power Jacks, Rail Drills, Railroad

Brakeman,Rail Saws, Spike Drivers (Manually or hand held tool) Spike Pullers Tamping Machine, Thermitweld

GROUP 3: Asphalt Luteman/Raker,Blacksmith, Blaster, Brick, stone and block pavers and block cutters (wood, belgian and asphalt); Cement mortar lining car pusher; Cement mortar mixer (pipe relining); Cement mortar pipe reliners; concrete saw operator (walk behind); Curb cutters and setters; Elevated roadway drainage construction; erector of overhead signs, Form setter (road forms-lead man); Grout machine operator; Gunite or dry pack gun (nozzle and machine man); Manhole or catch basin builder (Brick block concrete or any prefabrication) Miners and drillers (including lining, supporting and form workmen, setting of shields, miscellaneous equipment and jumbos); Multi-plate pipe (aligning and securing); Placing wire mesh on gunite projects; Wagon drill operators (air track or similar); Walk behind ditching machine (trencher or similar);crown screed adjuster and welder

GROUP 4: Reinforcing Steel Placer (Bending, aligning, and securing, Cadweld)

GROUP 5:High Burner, (Any burning not done from deck), Welder (Pipeline)

GROUP 6: Uniformed Flagperson, Watchman

GROUP 7: Toxic/Hazardous Waste Removal Laborer Levels C & D

GROUP 8: Toxic/Hazardous Waste Removal Laborer Levels A & B

PAIN0021-019 05/01/2018

CLINTON COUNTY

	Rates	Fringes
Painters:		
Bridge.....	\$ 36.67	18.80
Brush & Roller.....	\$ 27.67	18.80
Spray.....	\$ 28.67	18.80

PAIN0021-024 05/01/2018

FRANKLIN COUNTY

	Rates	Fringes
PAINTER		
Brush.....	\$ 23.92	14.23

PAIN0057-014 06/01/2018

ALLEGHENY, FAYETTE, GREENE, WASHINGTON COUNTIES

	Rates	Fringes
Painters:		
Bridge.....	\$ 34.60	19.12
Brush & Roller.....	\$ 28.00	19.12
Spray.....	\$ 28.00	19.12

PAIN0057-015 06/01/2018

ARMSTRONG, BEAVER, BEDFORD, BLAIR, BUTLER, CAMBRIA, CENTRE, CLARION, CLEARFIELD, ELK, FULTON, HUNTINGTON, INDIANA, JEFFERSON, LAWRENCE, MERCER, MIFFLIN, SOMERSET, VENANGO AND WESTMORELAND COUNTIES

Rates Fringes

Painters:

Bridge.....	\$ 34.60	19.12
Brush and Roller.....	\$ 28.00	19.12
Spray.....	\$ 28.00	19.12

PAIN0057-022 05/01/2017

Rates Fringes

Painters: (ERIE, McKEAN, AND WARREN (Including Columbus and Freehold twps) COUNTIES)

Bridges, Stacks, Towers.....	\$ 24.37	17.22
Brush and Roller.....	\$ 21.87	17.22
Spray and Sandblasting.....	\$ 22.62	17.22

PAIN0057-027 06/01/2016

CAMERON, CRAWFORD, POTTER, WARREN, (Excluding Columbus and Freehold twps)

Rates Fringes

PAINTER

Brush and Roller.....	\$ 25.99	16.67
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PLAS0526-002 01/01/2019

Rates Fringes

CEMENT MASON/CONCRETE FINISHER...	\$ 31.94	20.50
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PLUM0027-001 06/01/2017

ALLEGHENY, ARMSTRONG, GREENE (Except extreme Eastern portion), WASHINGTON (Except extreme Eastern portion) and WESTMORELAND (City of Arnold and City of New Kensington Only) COUNTIES

Rates Fringes

Plumbers and Pipefitters (Bridge Drain Pipe).....

.....	\$ 39.20	21.27
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PLUM0047-005 05/01/2013

BEAVER, BUTLER, McKEAN, MERCER, VENANGO, CLARION, LAWRENCE, FOREST, WARREN, CRAWFORD, AND ERIE COUNTIES

Rates Fringes

Plumbers and Pipefitters (Bridge Drain Pipe).....

.....	\$ 38.52	20.11
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PLUM0354-005 06/01/2012

BEDFORD, BLAIR, CAMBRIA, CAMERON, CLEARFIELD, ELK, FAYETTE, GREENE (Extreme Eastern portion), HUNTINGDON, INDIANA, JEFFERSON, SOMERSE, WASHINGTON (Extreme Eastern portion), AND WESTMORELAND COUNTIES

	Rates	Fringes
Plumbers and Pipefitters (Bridge Drain Pipe).....	\$ 35.54	19.97

TEAM0040-001 01/01/2019

	Rates	Fringes
TRUCK DRIVER (ALLEGHENY, ARMSTRONG, BEAVER, BLAIR, BUTLER, CAMBRIA, CENTRE, CLARFIELD, CRAWFORD, ERIE, FAYETTE, GREENE, INDIANA, JEFFERSON, LAWRENCE, MCKEAN, MERCER, SOMERSET, VENANGO, WARREN, WASHINGTON, AND WESTMORELAND)		
GROUP 1.....	\$ 28.99	19.43
GROUP 2.....	\$ 29.13	19.51
GROUP 3.....	\$ 29.59	19.82
Truck drivers: (BEDFORD, CAMERON, CLAIRON, CLINTON, ELK, FOREST, FRANKLIN, FULTON, HUNTINGDON, MIFFLIN, AND POTTER COUNTIES)		
GROUP 1.....	\$ 28.83	19.32
GROUP 2.....	\$ 28.99	19.43
GROUP 3.....	\$ 29.45	19.73

FOOTNOTES: A. Hazardous/toxic waste material/work level A & B receive additional \$2.50 per hour above classification rate

B. Hazardous/toxic waste materials/Work level C & D receive \$1.00 per hour above classification

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1 - Single Axle (2 axles including steering axle); Includes partsman and warehoueman

GROUP 2 - Tandem - Tri-Axle - Semi-Tractor Trailer (combination) (3 axles or more including steering axle)

GROUP 3 - Specialty Vehicles; Heavy equipment whose capacity exceeds that for which state licenses are issued specifically refers to units in excess of eight (8) feet width (such as Euclids, Atley Wagon, Payloader, Tournawagons, and similar equipment when not self loaded); Tar and Asphalt Distributors Trucks, Heavy Duty Trailer, such as Low Boy, High Boy

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.

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)).

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.

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

ATTACHMENT 3

PENNSYLVANIA GRANT ASSURANCES

COMMONWEALTH OF PENNSYLVANIA GRANT ASSURANCES FOR CONSTRUCTION CONTRACTS

STEEL PRODUCTS

The contractor's attention is directed to the provisions of Act 3 enacted by the General Assembly of the Commonwealth of Pennsylvania and approved by the Governor on March 3, 1978, which specifies that if any products are to be used or supplied in the performance of the contract, only steel products produced in the United States shall be used in the performance of the contract or any subcontract.

The contractor's attention is also directed to Act 144 enacted by the General Assembly of the Commonwealth of Pennsylvania and approved July 9, 1984. Act 144 amends Act 3 of March 3, 1978.

The contractor shall provide a certification to the Engineer with each shipment of steel products delivered to the project site that such steel products comply with this act.

The provisions of this Act shall not be considered as waived under any circumstances unless the Chairman of the Airport Authority has determined, under authority granted in Section 4(B) of the Act that a certain steel product or products are not produced in the United States in sufficient quantities to meet the requirements of the contract. Such a determination will be set forth in the proposal or in any addendum to the proposal.

Steel products are defined as products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed or processed by a combination of two or more of such operations from steel made in the United States by the open hearth, basic oxygen, electric furnace, Bessemer or other steel making process.

EQUAL EMPLOYMENT OPPORTUNITY CLAUSE

During the performance of this Contract, the Contractor agrees as follows:

1. The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor shall take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to their race, color, religion, sex 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 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 shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants shall receive consideration for employment without regard to race, color, religion, sex, or national origin.
3. The Contractor shall send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice (to be provided) advising that 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 shall comply with all provisions of Executive Order 11246, as amended, of September 24, 1965, and the rules, regulations, and relevant orders of the Secretary of Labor.
5. The Contractor shall furnish all information and reports required by Executive Order 11246, as amended, of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and shall permit access to his books, records, and accounts by the Comptroller General of the United States, Department of Transportation, FAA 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, as amended, of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246, as amended, September 24, 1965, or by rules, regulation, or order of the Secretary of Labor, or as otherwise provided by laws.
7. The Contractor shall 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, as amended, September 24, 1965, so that such provisions shall be binding upon each Subcontractor or vendor. The Contractor shall take such action with respect to any Subcontract or Purchase Order as the FAA may direct as a means of enforcing such provisions, including sanctions for noncompliance; provided, however, that in the event the Contractor becomes involved in, or is threatened with litigation with a Subcontractor or vendor as a result of such direction by the FAA, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

The Contractor and Subcontractors may satisfy the requirements of Paragraph 2 of the referenced EEO clause by complying with any of the following:

Stating in the Invitations for Bids that all qualified applicants shall receive consideration for employment without regard to race, color, religion, sex, or national origin, or

Including appropriate insignia in display or other advertising as prescribed by the Department of Labor, or

Using a single advertisement grouped with other advertisements under a caption which clearly states that all employers in the group assure all qualified applicants will have equal consideration for employment without regard to race, color, religion, sex, or national original, or

Using the phrase "an equal opportunity employer" in a single advertisement in clearly distinguishable type.

SEE POSTER NEXT PAGE

NOTICES TO BE POSTED PER PARAGRAPHS (1) AND (3) OF THE EEO CLAUSE

EQUAL EMPLOYMENT OPPORTUNITY IS THE LAW-DISCRIMINATION IS PROHIBITED BY THE CIVIL RIGHTS ACT OF 1964 AND BY-EFFECTIVE ORDER NO. 11246

Title VII of the Civil Rights Act of 1964 - Administered by:

THE EQUAL EMPLOYMENT OPPORTUNITY COMMISSION

Prohibits discrimination because of Race, Color, Religion, Sex, or National Origin by Employers with 75 or more employees, by Labor Organizations with a hiring hall of 75 or more members, by Employment Agencies, and by Joint Labor-Management, Consultants for Apprenticeship or Training. After July 1, 1967, employees or members will be covered; after July 1, 1968, those with 25 or more shall be covered.

ANY PERSON

Who believes he or she has been discriminated against
SHOULD CONTACT

THE EQUAL EMPLOYMENT OPPORTUNITY COMMISSION

1800 O Street NW, Washington, DC 20504

Executive Order No. 11246 - Administered
by:

THE OFFICE OF FEDERAL CONTRACT COMPLIANCE

Prohibits discrimination because of Race, Color, Religion, Sex or National Origin, and requires affirmative action to ensure equality of opportunity in all aspects of employment.

By all Federal Government Contractors and Subcontractors, and by Contractors Performing Work Under a Federal Assisted Construction Contract, regardless of the number of employees in either case.

ANY PERSON

Who believes he or she has been discriminated against
SHOULD CONTACT

THE OFFICE OF FEDERAL CONTRACT COMPLIANCE

U.S. Department of Labor Washington, DC 20210

OFFSET PROVISION FOR COMMONWEALTH CONTRACTS

The Contractor agrees that the State may offset the amount of any state tax or State liability of the Contractor or its affiliates and subsidiaries that is owed to the State against any payments due the Contractor under this or any other contract with the State.

CONTRACTOR RESPONSIBILITY PROVISIONS

For the purpose of these provisions, the term contractor is defined as any person, including, but not limited to, a bidder, offeror, loan recipient, grantee, or subgrantee who has furnished or seeks to furnish goods, supplies, services, or leased space, or who has performed or seeks to perform construction activity under contract, subcontract, grant, or subgrant with the State, or with a person under contract, subcontract, grant or subgrant with the State or its state affiliated entities and state-related institutions. The term contractor may include a permittee licensee, or any agency, political subdivision, instrumentality, public authority or other entity of the State.

(a) By executing the contract, the Contractor certifies, in writing, for itself and all its subcontractors, that neither the Contractor, nor any subcontractors, nor any suppliers are under suspension or debarment by any State or Federal governmental entity, instrumentality, or authority.

(b) The Contractor must also certify, in writing, that as of the date of its execution, of any State contract it has no tax liabilities or other State obligations.

(c) The Contractor's obligations pursuant to these provisions are ongoing from and after the effective date of the contract through the termination date thereof. Accordingly, the Contractor shall have an obligation to inform the contracting agency if, at any time during the term of the contract, it becomes delinquent in the payment of taxes, or other State obligations, or if it or any of its subcontractors are suspended or debarred by the State, the federal government, or any other state or governmental entity. Such notification shall be made within 15 days of the date of suspension or debarment.

(d) The failure of the Contractor to notify the contracting agency of its suspension or debarment by the State, any other state, or the federal government shall constitute an event of default of the contract with the State.

(e) The Contractor agrees to reimburse the State for the reasonable costs of investigation incurred by the Office of State Inspector General for investigations of the Contractor's compliance with the terms of this or any other agreement between the Contractor and the State, which results in the suspension or debarment of the Contractor. Such costs shall include, but shall not be limited to, salaries of investigators, including overtime; travel and lodging expenses; and expert witness and documentary fees. The Contractor shall not be responsible for investigative costs for investigations that do not result in the Contractor's suspension or debarment.

(f) The Contractor may obtain current lists of suspended and debarred entities at: <http://www.dgs.state.pa.us> by clicking on Doing Business with the Commonwealth, then Procurement, then Debarment List, and at <http://epls.arnet.gov>.

PROVISIONS FOR COMMONWEALTH CONTRACTS CONCERNING THE AMERICANS WITH DISABILITIES ACT

During the term of this contract, the Contractor agrees as follows:

Pursuant to federal regulations promulgated under the authority of the Americans With Disabilities Act, 28 CFR, 35.101 et seq., the Contractor understands and agrees that no individual with a disability is to be excluded from participation in this contract or from activities provided for under this contract on the basis of the disability. As a condition of accepting and executing this contract, the Contractor agrees to comply with the "General Prohibitions Against Discrimination," 28 CFR, 35.130, and all other regulations promulgated under Title II of The Americans With Disabilities Act which are applicable to the benefits, services, programs, and activities provided by the State through contracts with outside contractors.

The Contractor is to be responsible for and agrees to indemnify and hold harmless the State from all losses, damages, expenses, claims, demands, suits, and actions brought by any party against the State as a result of the Contractor's failure to comply with the above provisions.

ANTI-POLLUTION MEASURES

The Bidder shall thoroughly acquaint himself with the terms of the statutes, rules and regulations enumerated in this Special Requirement, and shall include in the Bid Prices all costs of complying with the terms of the listed statutes, rules and regulations. No separate or additional payment shall be made for such compliance. In the event that the listed statutes, rules and regulations are amended, or if new statutes, rules and regulations become effective, which cause the Contractor to perform Additional Work, the Owner shall issue a Change Order setting forth any Additional Work that must be undertaken. This Change Order shall not invalidate the Contract. The Change Order shall specify the amount of additional payment, if any, that shall be made to the Contractor. If the Owner and the Contractor cannot arrive at a mutually agreeable price for the Additional Work, payment shall be made in accordance with Section 90-05 of the General Provisions. No payment shall be made for Work performed without written authorization to do so.

The Contractor shall determine what, if any, local ordinances, codes and regulations apply to his Work. He shall comply with all such ordinances, codes and regulations.

**PART I, SECTION A
PENNSYLVANIA STATUTES**

The listed State and Federal statutes and regulations are for informational use. Not all of the statutes and regulations that may be applicable are listed. In addition, statutes and regulations and amendments to existing statutes and regulations new are promulgated at various times and sections of the statutes and regulations are renumbered.

Act Relating to Abandoned Mines, Act of May 7, 1935, 52 Pa. Stat. §§ 809 et seq., as amended.

Act Relating to Black Powder, Act of May 31, 1974, 73 Pa. Stat. §§ 169 et seq., as amended.

Act Relating to Camp Regulation, Act of Nov. 10, 1959, 35 Pa. Stat. §§ 3001 et seq., as amended.

Act Relating to Cave-in or Subsidence of Surface Above Mines, Act of July 2, 1937, 52 Pa. Stat. §§ 1407 et seq., as amended.

Act Relating to Caving-in, Collapse, Subsidence, Act of May 27, 1921, 52 Pa. Stat. §§ 661 et seq., as amended.

Act Relating to Coal Land Improvement, Act of July 19, 1965, 52 Pa. Stat. §§ 30.101 et seq., as amended.

Act Relating to Coal Mine Subsidence Insurance Fund, Act of Aug. 23, 1961, 52 Pa. Stat. §§ 3201 et seq., as amended.

Act Relating to Coal Stripping, Act of June 18, 1941, 52 Pa. Stat. §§ 1471 et seq., as amended.

Act Relating to Coal Under State Lands, Act of June 1, 1933, 52 Pa. Stat. §§ 1501 et seq., as amended.

Act Relating to Control and Drainage of Water from Coal Formations, Act of July 7, 1955, 52 Pa. Stat. §§ 682 et seq., as amended.

Act Relating to Delaware River Pollution, Act of Apr. 19, 1945, 32 Pa. Stat. §§ 815.31 et seq., as amended.

Act Relating to Discharge of Coal into Banks of Streams, Act of June 27, 1913, 52 Pa. Stat. §§ 631 et seq., as amended.

Act Relating to Excavation and Demolition, Act of Dec. 10, 1974, 73 Pa. Stat. §§ 176 et seq., as amended.

Act Relating to Explosives, Act of July 1, 1937, 73 Pa. Stat. §§ 151 et seq., as amended.

Act Relating to Explosives, Act of July 10, 1957, 73 Pa. Stat. §§ 164 et seq., as amended.

Act Relating to Flood Control, Act of Aug. 7, 1936, 32 Pa. Stat. §§ 653 et seq., as amended.

Act Relating to General Safety, Act of May 18, 1937, 43 Pa. Stat. §§ 25-1 et seq., as amended.

Act Relating to Hazardous Materials Transport, Act of June 30, 1984, 75 Pa. C.S.A. §§ 8301 et seq., as amended.

Act Relating to Junkyards along Highways, Act of July 28, 1966, 36 Pa. Stat. §§ 2719.1 et seq., as amended.

NON-DISCRIMINATION/SEXUAL HARASSMENT CLAUSE

During the term of the Contract, the Contractor agrees as follows:

(a) In the hiring of any employees for the manufacture of supplies, performance of work, or any other activity required under the Contract or any subcontract, the Contractor, subcontractor or any person acting on behalf of the Contractor or subcontractor shall not by reason of gender, race, creed, or color discriminate against any citizen of this State who is qualified and available to perform the work to which the employment relates.

(b) Neither the Contractor nor any subcontractor nor any person on their behalf shall in any manner discriminate against or intimidate any employee involved in the manufacture of supplies, the performance of work or any other activity required under the Contract on account of gender, race, creed, or color.

(c) The Contractor and any subcontractors shall establish and maintain a written sexual harassment policy and shall inform their employees of the policy. The policy must contain a notice that sexual harassment will not be tolerated and employees who practice it will be disciplined.

(d) The Contractor shall not discriminate by reason of gender, race, creed, or color against any subcontractor or supplier who is qualified to perform the work to which the contract relates.

(e) The Contractor and each subcontractor shall furnish all necessary employment documents and records to and permit access to its books, records, and accounts by the contracting officer and the Department of General Services', Bureau of Contract Administration and Business Development (DGS, BCABD) for purposes of investigation to ascertain compliance with the provisions of this Nondiscrimination/Sexual Harassment Clause. If the Contractor or any subcontractor does not possess documents or records reflecting the necessary information requested, it shall furnish such information on reporting forms supplied by the contracting officer or the BCABD.

(f) The Contractor shall include the provisions of this Nondiscrimination/Sexual Harassment Clause in every subcontract so that such provisions will be binding upon each subcontractor.

(g) The State may cancel or terminate the Contract, and all money due or to become due under the Contract may be forfeited for a violation of the terms and conditions of this Nondiscrimination/Sexual Harassment Clause. In addition, the agency may proceed with debarment or suspension and may place the Contractor in the Contractor Responsibility File.

CONTRACTOR INTEGRITY PROVISIONS

(a) For purposes of this clause only, the words "confidential information," "consent," "contractor," "financial interest," and "gratuity" shall have the following definitions.

1. Confidential information means information that is not public knowledge, or available to the public on request, disclosure of which would give an unfair, unethical, or illegal advantage to another desiring to contract with the State.

2. Consent means written permission signed by a duly authorized officer or employee of the State, provided that where the material facts have been disclosed, in writing, by prequalification, bid, proposal, or contractual terms, the State shall be deemed to have consented by virtue of execution of this agreement.

3. Contractor means the individual or entity that has entered into the Contract with the State, including directors, officers, partners, managers, key employees and owners of more than a 5% interest.

4. Financial interest means:

4.a Ownership of more than a 5% interest in any business; or

4.b Holding a position as an officer, director, trustee, partner, employee, or the like, or holding any position of management.

5. Gratuity means any payment of more than nominal monetary value in the form of cash, travel, entertainment, gifts, meals, lodging, loans, subscriptions, advances, deposits of money, services, employment, or contracts of any kind.

(b) The Contractor shall maintain the highest standards of integrity in the performance of the Contract and shall take no action in violation of State or federal laws, regulations, or other requirements that govern contracting with the State.

(c) The Contractor shall not disclose to others any confidential information gained by virtue of the Contract.

(d) The Contractor shall not, in connection with this or any other agreement with the State, directly, or indirectly, offer, confer, or agree to confer any pecuniary benefit on anyone as consideration for the decision, opinion, recommendation, vote, other exercise of discretion, or violation of a known legal duty by any officer or employee of the State.

(e) The Contractor shall not, in connection with this or any other agreement with the State, directly or indirectly, offer, give, or agree or promise to give to anyone any gratuity for the benefit of or at the direction or request of any officer or employee of the State.

(f) Except with the consent of the State, neither the Contractor nor anyone in privity with him or her shall accept or agree to accept from, or give or agree to give to, any person, any gratuity from any person in connection with the performance of work under the Contract except as provided therein.

(g) Except with the consent of the State, the Contractor shall not have a financial interest in any other contractor, subcontractor, or supplier providing services, labor, or material on this project.

(h) The Contractor, upon being informed that any violation of these provisions has occurred or may occur, shall immediately notify the State in writing.

(i) The Contractor, by execution of the Contract and by the submission of any bills or invoices for payment pursuant thereto, certifies, and represents that he or she has not violated any of these provisions.

(j) The Contractor, upon the inquiry or request of the Inspector General of the State or any of that official's agents or representatives, shall provide, or if appropriate, make promptly available for inspection or copying, any information of any type or form deemed relevant by the Inspector General to the Contractor's integrity or responsibility, as those terms are defined by the State's statutes, regulations, or management directives. Such information may include, but shall not be limited to, the Contractor's business or financial records, documents, or files of any type or form that refer to or concern the Contract. Such information shall be retained by the Contractor for a period of 3 years beyond the termination of the Contract unless otherwise provided by law.

(k) For violation of any of the above provisions, the State may terminate this and any other agreement with the Contractor, claim liquidated damages in an amount equal to the value of anything received in breach of these provisions, claim damages for all expenses incurred in obtaining another Contractor to complete performance hereunder, and debar and suspend the Contractor from doing business with the State. These rights and remedies are cumulative, and the use or nonuse of any one shall not preclude the use of all or any other. These rights and remedies are in addition to those the State may have under law, statute, regulation, or otherwise.

INSURANCE

The awarded Contractor must furnish and keep in full force, during the term of this contract, the following insurances:

Unless waived by the Owner in writing, Contractor shall obtain insurance of the types and in the amounts described below:

(1) Commercial General and Umbrella Liability Insurance.

(a) Contractor shall maintain Commercial General Liability (CGL) and, if necessary, Commercial Umbrella Insurance with a limit of not less than \$1,000,000 each occurrence. If such CGL insurance obtains a general aggregate limit, it shall apply separately to this location or project. CGL insurance shall be written on ISO occurrence form (or substitute form providing equivalent coverage). The Owner, the Engineer, and the Commonwealth of Pennsylvania shall be included as an insured under the CGL, using ISO additional insured endorsement CG2026 or a substitute providing equivalent coverage, and under the Commercial Umbrella, if any. This insurance shall apply as primary insurance with respect to any other insurance or self-insurance programs afforded to the Owner. There shall be no endorsement or modification of the CGL policy which limits coverage for liability arising from claims based on sexual abuse or molestation. If such an endorsement has been added to the Contractor's CGL insurance, Contractor shall be required to obtain separate insurance coverage for claims based on sexual abuse or molestation.

(2) Business Automobile and Umbrella Liability Insurance.

(a) Contractor shall maintain Business Automobile Liability, and if necessary, Commercial Umbrella Liability insurance with a limit of not less than \$1,000,000 each accident. Such insurance shall cover liability arising out of any automobile, including owned, hired and non-owned automobiles. Business automobile coverage shall be written on ISO form CA0001 or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide Contractual Liability coverage equivalent to that provided in the 1990 and later editions of CA0001.

(3) Workers Compensation Insurance.

Contractor shall maintain Workers Compensation and Employers Liability Insurance.

(a) The Employers Liability and/or Umbrella Liability limits shall not be less than \$100,000 each accident for bodily injury by accident, \$100,000 each employee for bodily injury by disease, \$500,000 policy limit for bodily injury by disease.

(4) Insurance Requirements for all Policies.

(a) Contractor waives all rights against the Owner and its agents, officers, directors, employees and the Commonwealth of Pennsylvania for recovery of damages to the extent these damages are covered by the Commercial General Liability, Automobile Liability, or Umbrella Liability Insurance maintained pursuant to previous paragraph of this agreement.

(b) By requiring insurance herein, the Owner does not represent that coverage and limits will necessarily be adequate to protect contractor, and such coverage and limits shall not be deemed as a limitation on Contractor's Liability under the indemnities granted to the Owner in this contract.

(c) If Contractor's Liability does not contain the standard ISO separation of insured's provision, or a substantially similar clause, they shall be endorsed to provide Cross-Liability coverage.

(d) Prior to the commencement of terms of this contract, contractor shall furnish the Owner with a certificate of insurance, executed by a duly authorized representative of each insurer, showing compliance with the insurance requirements set forth above.

(e) All certificates of insurance shall provide for 30 days' written notice to the Owner prior to the cancellation or material change of any insurance referred to therein.

(f) Failure of the Owner to demand such certificate or other evidence of full compliance with these insurance requirements or failure of the Owner to identify a deficiency from evidence that is provided shall not be construed as a waiver of contractor's obligation to maintain such insurance.

(g) Failure to maintain the required insurance may result in termination of this contract or other punitive measures, such as withholding payments or denying access to the premises at the Owner's option.

(h) The contractor must agree to hold harmless and indemnify the Owner and its officials from and against any and all liability arising out of any action, claimed demand, suit, or cause of action which may be made or asserted against the Owner and its officials by reason of any acts of the agency, or its performance of the services contemplated by this contract. The contractor insurance policy including: Commercial General Liability, Automobile Liability, or Umbrella Liability Insurance must be endorsed to include the Owner, the Engineer and the Commonwealth of Pennsylvania as additional insured.

(i) Certificates of Insurance must be delivered to the Owner within five (5) days after the award evidencing these coverages.

(j) Insurance as required in the foregoing paragraphs shall be placed with an insurer acceptable to the Owner with a Best Rating of A- or better.

ATTACHMENT 4

GEOTECHNICAL ENGINEERING REPORT

GEOTECHNICAL ENGINEERING REPORT

**ERIE INTERNATIONAL AIRPORT
SNOW REMOVAL EQUIPMENT BUILDING
ERIE COUNTY, PENNSYLVANIA**

Prepared for

**Michael Baker International
Moon Township, Pennsylvania**

Prepared by

**American Geotechnical & Environmental Services, Inc.
Canonsburg, Pennsylvania**

MAY 2018

A.G.E.S., INC. PROJECT NO. 18056



American Geotechnical & Environmental Services, Inc.



American Geotechnical & Environmental Services, Inc.

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May 21, 2018

Ms. Dawn Spence, P.E.
Michael Baker International
Airside Business Park
100 Airside Drive
Moon Township, Pennsylvania 15108

Re: **Geotechnical Engineering Report**
Erie International Airport
Snow Removal Equipment Building
Erie County, Pennsylvania
A.G.E.S., Inc. Reference Number 18056

Dear Ms. Spence:

American Geotechnical & Environmental Services (A.G.E.S.), Inc. is pleased to present our Geotechnical Engineering Report for the above referenced project. This report contains the data obtained from the drilling program and an evaluation of the existing materials as foundation bearing materials. Additionally, geotechnical recommendations are provided for the design of the foundations for the proposed Snow Removal Equipment Building and the Sand/Salt Storage Building; and site preparation.

We wish to extend our appreciation for this opportunity to be of service to you. Should you have any questions, or require additional information, please contact us.

Sincerely,

American Geotechnical & Environmental Services, Inc.

Rochelle L. Dale, P.E.
Project Engineer

Thomas F. Farrell, P.E.
Project Manager

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1.0 INTRODUCTION

1.1 Purpose of Investigation

The objective of this investigation was to evaluate the engineering characteristics and distribution of the subsurface soils and groundwater at the site. The subsurface conditions were evaluated to develop geotechnical design parameters for the anticipated foundation bearing materials.

1.2 Scope of Investigation

The scope of work performed during this investigation consisted of the following:

- Drilled eight (8) borings to obtain information on the subsurface conditions;
- Evaluated if the existing subgrade materials are suitable as a bearing material;
- Prepared this report summarizing the data obtained and presenting an evaluation regarding the suitability of the existing subsurface conditions for the proposed construction. Additionally, this report includes recommendations on site preparation and geotechnical parameters for the design of the foundations for the proposed Snow Removal Equipment (SRE) Building and the Sand/Salt Storage (SS) Building.

1.3 Proposed Construction

The proposed construction consists of building an approximately 75 foot by 220 foot Snow Removal Equipment (SRE) Building, an approximately 80 foot by 50 foot Sand/Salt Storage Building (SS) and an access road/parking lot.

2.0 SUBSURFACE INVESTIGATION

A subsurface investigation consisting of eight (8) borings was conducted to obtain information on the subsurface conditions. Borings SRE-1 to SRE-4 were drilled for the proposed SRE Building; Borings SS-1 to SS-2 were drilled for the proposed Sand/Salt Storage Building; and Borings P-1 and P-2 were drilled for the proposed the access road/parking lot. The boring locations were selected by A.G.E.S., Inc. and field marked/surveyed by Sheesley & Associates, LLC (Sheesley). Boring coordinates and elevations were provided by Michael Baker International and Sheesley. The project location is shown on the General Location Map and the Project Location Map, Figures 1 and 2, respectively. The locations of the borings are shown on the Boring Location Plan (Figure 3).

The borings were completed by R. Rindfuss Drilling, L.P. between May 07, 2018 and May 08, 2018. A.G.E.S., Inc. provided the services of a full-time inspector during drilling to log the soil samples.

The borings were advanced continuously through the soil using a 2-inch O.D. split-spoon sampler and hollow stem augers to a depth of 10.5 feet and then at 3-foot intervals thereafter. The split-spoon sampler was driven 18 inches using a 140-pound hammer falling 30 inches. The blows required to drive the sampler each six inch increment were recorded. The purpose of the first 6-inches is to penetrate any loose soil left by the auger. The cumulative number of blows required to drive the sampler through the last two 6-inch increments is designated as the Standard Penetration Resistance. The penetration resistance provides an indication as to the in-place relative density of granular soils, and the consistency of fine-grained soils. Relative densities and consistencies are an indication of the shear strength and compressibility of the soils. Penetration resistance values along with our visual identification of the soils are included on the Engineer's Field Boring Logs in Appendix A.

Groundwater levels were recorded in the borings immediately upon completion. Borings SRE-1 to SRE-3 and SS-1 were grouted upon completion and the 24-hour ground water level readings for the remainder of the borings were taken prior to grouting.

3.0 SUBSURFACE CONDITIONS

The subsurface conditions encountered are summarized below and in Table 1. The subsurface conditions are based on the Engineer's Field Boring Logs and the laboratory test results, which are provided in Appendix A and Appendix B, respectively.

3.1 SRE Borings

Four (4) borings were drilled for the proposed Snow Removal Equipment (SRE) Building. Borings SRE-1 to SRE-3 were drilled to a depth of 19.5 feet. Boring SRE-4 was drilled deeper to a depth of 25.5 feet due to low SPT N-values. Boring SRE-3 encountered 1.5 feet of Bituminous Concrete/Subbase at the top of the boring. Fill material was encountered in Borings SRE-1 to SRE-3 and generally consisted of loose to medium dense sand with varying amounts of silt and gravel (sm/a-2-4, sw/a-1-b). Glacial till was encountered in each of the borings and generally consisted of layers of sand with varying amounts of silt, clay and gravel (SM/A-4 to sp/a-1-b) ranging from a very loose to dense relative density and silt with varying amounts of sand, clay and gravel (ML/A-4, ml/a-4) ranging from a soft to stiff consistency.

The 0-hour groundwater elevation readings ranged from EL. 708.0 feet to EL. 715.3 feet. There were no 24-hour groundwater elevation readings for Borings SRE-1 to SRE-3 as they were all grouted upon completion. The 24-hour groundwater elevation in Boring SRE-4 was encountered at EL. 708.3 feet.

3.2 SS Borings

Two (2) borings were drilled for the proposed Sand/Salt Storage (SS) Building. Borings SS-1 and SS-2 were drilled to depths of 25.5 feet and 16.5 feet, respectively. Boring SS-1 was extended deeper due to low SPT N-values. Glacial till was encountered in both borings and consisted primarily of sand and silt with varying amounts of clay and gravel (SM/A-4, sm/a-2-4)

ranging from a very loose to medium dense relative density. Boring SS-1 also encountered a thin layer of very soft to medium stiff silt with little sand (ml/a-4).

The 0-hour groundwater elevation readings ranged from EL. 711.0 feet to EL. 711.2 feet. There were no 24-hour groundwater elevation readings for Boring SS-1 as it was grouted upon completion. The 24-hour groundwater reading in Boring SS-2 was dry.

3.3 Pavement Borings

Two (2) borings, P-1 and P-2 were drilled for the proposed access road and/or parking lot and extended to a depth of 10.5 feet. A layer of fill material was encountered in Boring P-1 and glacial till was encountered both Borings P-1 and P-2. The fill material consisted of medium dense sand with some silt (sm/a-2-4). The glacial till ranged from medium to very stiff clay with some silt, some sand, trace gravel (CL/A-6) to very loose to medium dense sand with some silt, trace gravel (sm/a-2-4). A bag sample collected for Boring P-1 included both the fill material and the glacial till. Laboratory tests of the composite bag sample resulted in a soil classification of CL/A-4.

The 0-hour and 24-hour groundwater readings obtained for both borings were recorded as dry.

4.0 LABORATORY TESTING

The laboratory testing program was developed to provide information regarding the engineering characteristics of the existing subsurface materials across the site. Index property tests, such as Moisture Content, Gradation, and Atterberg Limits were conducted on representative soil samples and are used to verify the field classifications. The soil classifications ranged from CL/A-6(6) to SM/A-4(0) with moisture contents ranging from 10.1 to 28.6 percent.

Additionally, Standard Proctor and CBR tests were conducted to determine the optimum moisture and maximum dry density for CBR testing and subgrade strength parameters. The optimum moisture content ranged from 16.0 to 17.3%, while the maximum dry density varied from 115.5 to 117.9 pcf. The CBR values ranged from 4.5 to 4.6 percent for 0.10 inch of penetration. The laboratory test results are provided in Appendix B and are summarized in Table 2.

5.0 EVALUATION

5.1 Foundation Bearing Materials

The finished floor elevation for both the Snow Removal Equipment (SRE) Building and the Sand/Salt Storage (SS) Building will be 725.90 feet which is near existing grade. The existing fill/glacial till materials are suitable foundation bearing materials for both structures. Based on the Standard Penetration Test results, allowable bearing pressure for foundations placed on the in-place fill/glacial till material should be 2000 pounds per square foot.

Loading information provided by Michael Baker International indicates the maximum column loads for the Snow Removal Equipment (SRE) Building are 47 kips. Based on the recommended allowable bearing capacity of 2000 psf, the maximum footing size would be a 5 foot by 5 foot footing. Loads on continuous (strip footings) for the buildings are not known at this time but the continuous footings are expected to be lightly loaded.

Settlement of the 5 foot by 5 foot individual footings was calculated to be about 1 inch or less, which is generally considered to be acceptable for this type of structure. Settlement of the continuous (strip footings) is also expected to be about 1 inch or less.

5.2 Groundwater Conditions

Groundwater is not expected to be a concern as the zero hour water levels indicated the groundwater is below the anticipated foundation bearing elevation.

5.3 Frost Depth

Based on procedures outlined in PennDOT Publication 242, a frost depth of 45 inches has been obtained.

5.4 Site Soil Classification

The subsurface investigation indicated the material at the site consists of at least 10.5 to 25.5 feet of soft to stiff/very loose to dense fill/glacial till material. The average SPT N-value is 9. Therefore, according to AASHTO Table 3.10.3.1-1 – Site Class Definitions, the project location belongs to Soil Site Class E.

According to Figure 3.10.2.1-1 in AASHTO Design Manual, the site is located in Seismic Zone 1 with an acceleration coefficient of 0.05g. This results in a site factor $F_{PGA}=2.5$ per AASHTO Table 3.10.3.2-1.

6.0 RECOMMENDATIONS FOR DESIGN PURPOSES

Based on our evaluation of subsurface conditions, A.G.E.S., Inc. presents the following recommendations as general guidelines to be utilized in the design of the Snow Removal Equipment (SRE) Building, the Sand/Salt Storage (SS) Building and the access road/parking lot.

6.1 Site Preparation

- Remove any topsoil and existing pavement from the proposed construction area.
- Proof-roll the subgrade. Any soft, loose, or wet areas detected should be removed as directed by the Engineer and backfilled with properly compacted granular material. Overexcavate any other unsuitable material (such as topsoil) as directed by the Engineer and backfill with compacted suitable fill material.
- All excavations should be free from standing water. Direct surface water runoff away from the excavations.
- The material used to backfill any undercut should be placed in 8 inch loose layers, and compacted.
- All fill should be well graded, inert, free of any degradable or deleterious material, and should not contain particles larger than 6 inches in maximum dimension. If the lift thickness is reduced, a corresponding reduction should be made in the maximum allowable particle dimension.
- With the exception of topsoil, frozen soil, any organic soils, millings, construction debris, or large boulders, the excavated materials are suitable for use as fill. Moisture conditioning of the excavated materials may be required to achieve the required degree of compaction.

- Grade the apron such that the water drains away from the foundation for the proposed buildings.

6.2 Foundation Design Parameters

- Use continuous (strip) and individual spread footings bearing on existing fill/glacial till to support the load bearing walls and column loads, respectively.
- Size the foundations using an allowable soil bearing pressure of 2,000 psf. Use minimum footing widths of one and one half (1.5) and three (3) feet for continuous and individual footings, respectively. These minimum widths are suggested to reduce the potential for a local shear or “punching” failure of the soil bearing subgrade.
- Place the bottom of the proposed foundations a minimum of forty-five (45) inches below the finished grade to protect against heave due to frost penetration.
- Use a Site Seismic Soil Classification of E.
- Use a Peak Ground Acceleration coefficient of 0.05g.

6.3 Pavement Recommendations

- Use a CBR value of 4.5 for new pavement.
- Use a frost heave rate of 8mm/day for CL/A-6 for subgrade soils.

6.4 Monitoring and Testing

- Have a qualified geotechnical engineer present at the site to conduct inspection of bearing material for each foundation element.
- Have a qualified Soils Technician under the direct supervision of a Geotechnical Engineer present at the site to physically inspect all backfilling, proof-rolling, and foundation excavation operations.
- Have a qualified Soils Technician under the direct supervision of a Geotechnical Engineer present at the site to physically inspect the surface material prior to placing the subbase material. It will be his or her responsibility to verify the suitability of the existing subgrade materials.
- Have a qualified Soils Technician under the direct supervision of the Geotechnical Engineer present at the site to monitor placement and compaction of fill material and to ensure that the specified density requirements are being achieved and, thus, minimize settlements of the fill/glacial till material.

7.0 LIMITATIONS

- This report has been prepared to present our recommendations with respect to the geotechnical aspects of the specific project discussed herein. In the event that there are any changes in the proposed structures, which formed the basis of our evaluation, these changes should be brought to our attention so that we may determine how such changes may affect our conclusions and recommendations.
- The evaluations and recommendations in this report are based on the conditions encountered at the specific times and locations sampled. It should be recognized that despite the use of due professional care, limitations on available data and variations between boring and sampling locations can result in some uncertainty with respect to the interpretation of these conditions and in the resultant recommendations.
- If the actual conditions encountered during construction vary from those reported herein, we are to be contacted to determine if the changes alter these recommendations.
- The conclusions and recommendations presented in this report have been prepared in accordance with the generally accepted professional geotechnical engineering principles and practices. No other warranties are implied or expressed.

FIGURES

PLT: JLM CKD: RLD QA/QC: TFF



SOURCE: PA Dept. of Transportation, General Highway Map; Erie County

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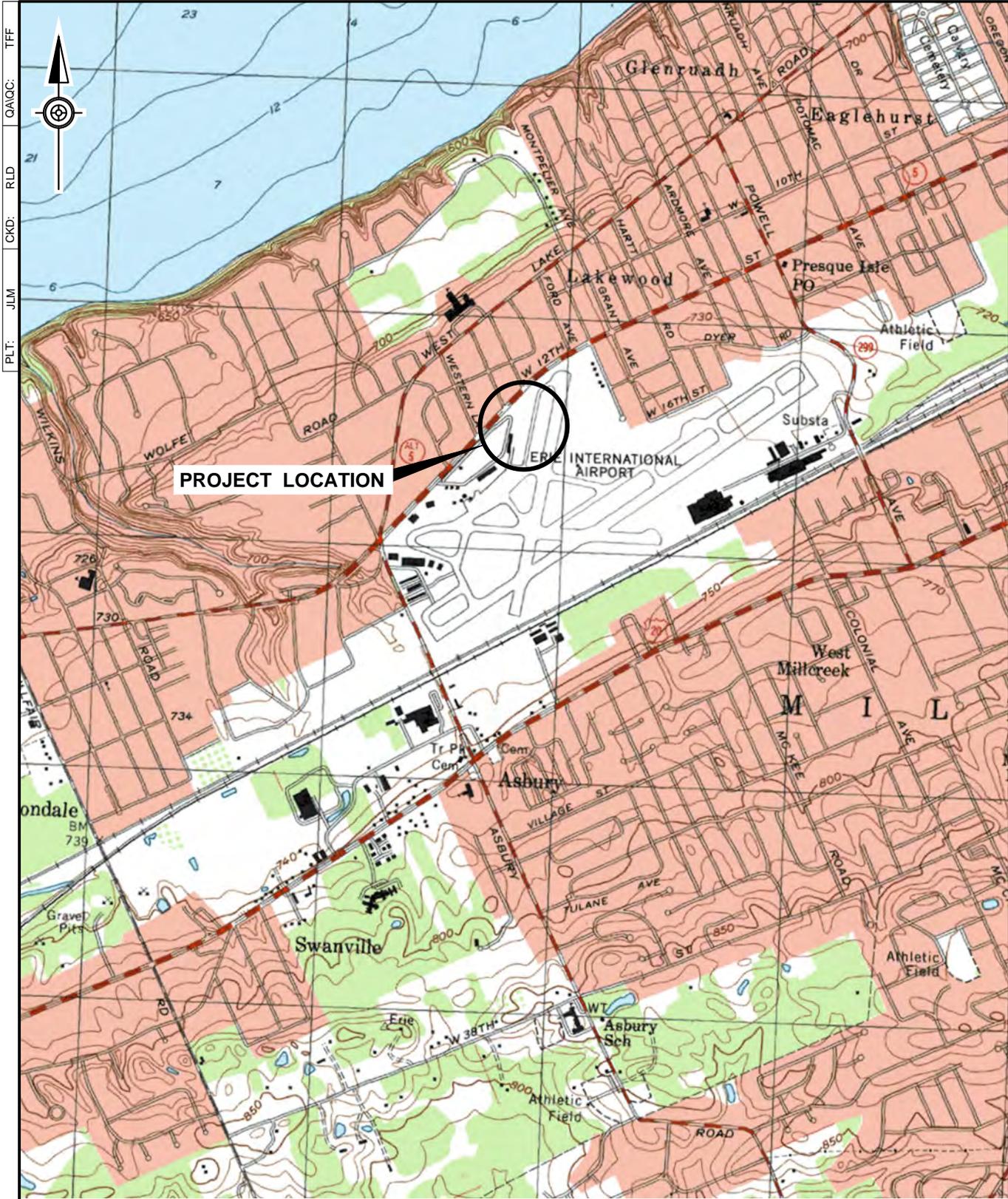
**ERIE INTERNATIONAL AIRPORT
SNOW REMOVAL EQUIPMENT BUILDING**

ERIE COUNTY, PENNSYLVANIA

GENERAL LOCATION MAP

PROJECT:	18056
DRAWN:	JLM
DATE:	MAY 2018
SCALE:	1" = 1 Mile
FIGURE:	1

File: M:_20180656\exhibits\misc\18056_gentl.dwg
Date: 5/18/18



PROJECT LOCATION

SOURCE: US Geological Survey, Quadrangle Map (7 1/2' Series); SWANVILLE PA



AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

Corporate Office: Canonsburg, PA (724) 916-0300
 Branch Offices: King of Prussia, PA (610) 354-0333
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 Baltimore, MD (410) 814-7552

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**ERIE INTERNATIONAL AIRPORT
 SNOW REMOVAL EQUIPMENT BUILDING**

ERIE COUNTY, PENNSYLVANIA

PROJECT LOCATION MAP

PROJECT: 18056

DRAWN: JLM

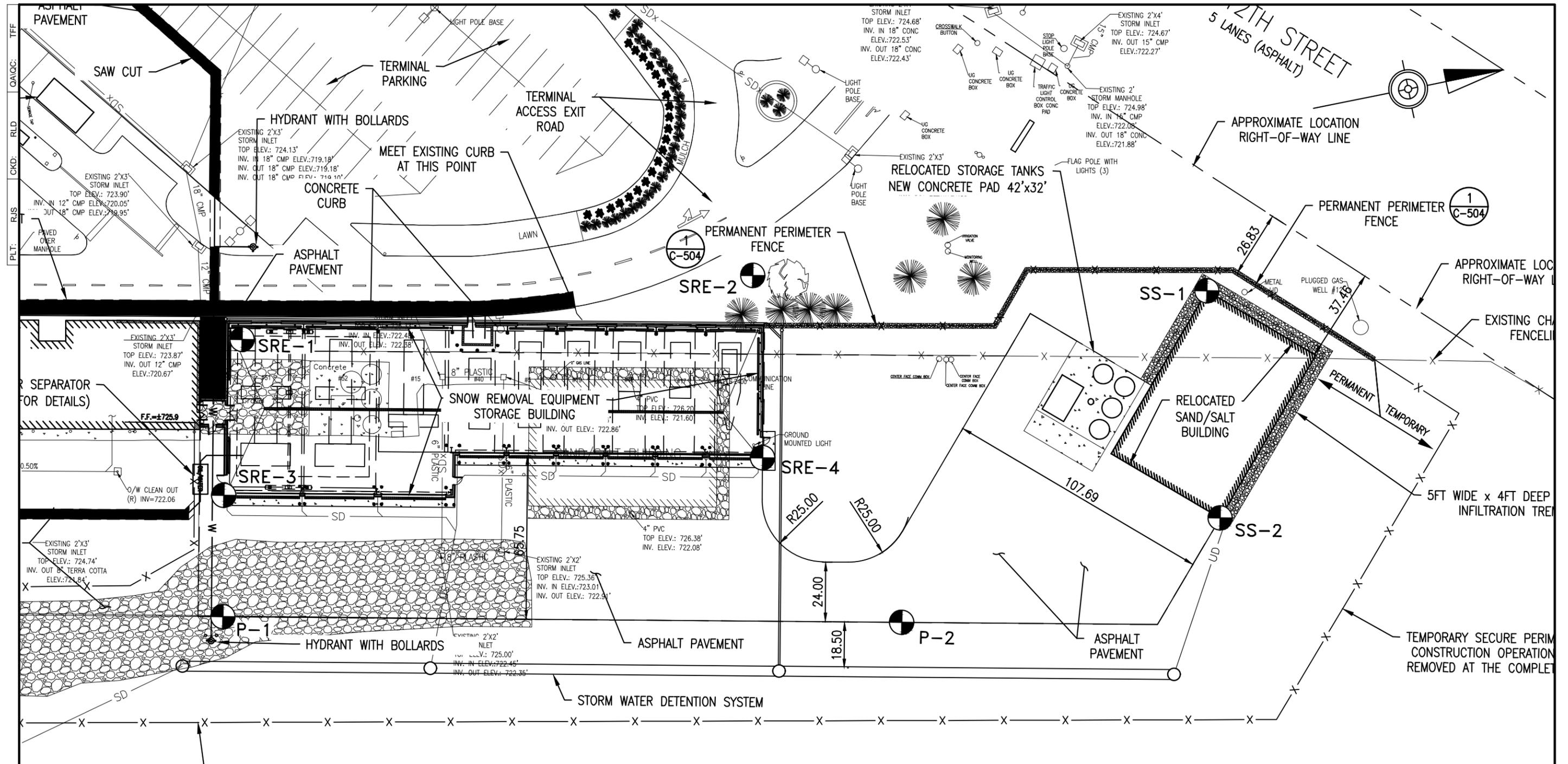
DATE: MAY 2018

SCALE: 1" = 2000'

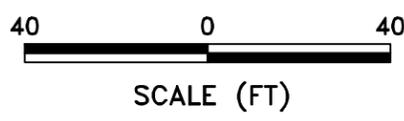
FIGURE: 2

File: M:_2018\06\exhibits\misc\18056_pjl.dwg
 Date: 5/18/18

PLT: JLM
 CKD:
 RLD
 QA/QC: TFF



TEMPORARY SECURE PERIMETER FENCING DURING CONSTRUCTION OPERATIONS. FENCE SHALL BE REMOVED AT THE COMPLETION OF THE PROJECT. 1
C-503



AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

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ERIE INTERNATIONAL AIRPORT
 SNOW REMOVAL EQUIPMENT BUILDING

ERIE COUNTY, PENNSYLVANIA

BORING LOCATION PLAN

PROJECT:	18056
DRAWN:	RJS
DATE:	MAY 2018
SCALE:	1" = 40'
FIGURE:	3

File: M:\20180506\exhibits\plan18056_btpn.dwg
Date: 5/16/18

TABLES

**TABLE 1
SUMMARY OF SUBSURFACE EXPLORATION
ERIE INTERNATIONAL AIRPORT
SNOW REMOVAL EQUIPMENT BUILDING
ERIE COUNTY, PENNSYLVANIA**

Boring Designation	Ground Surface Elevation (ft)	SOIL				ROCK		Bottom of Boring Elevation (ft)	0-Hour Water Elevation (ft)	24-Hour Water Elevation (ft)
		Pavement/ Subbase (ft)	Fill (ft)	Glacial Till (ft)	Soil Thickness (ft)	Top of Rock Elevation (ft)	Rock Cored (ft)			
SNOW REMOVAL EQUIPMENT BUILDING BORINGS										
SRE-1	725.0	-	3.0	16.5	19.5	-	-	705.5	715.2	*
SRE-2	726.2	-	3.5	16.0	19.5	-	-	706.7	709.2	*
SRE-3	725.8	1.5	1.5	16.5	19.5	-	-	706.3	715.3	*
SRE-4	725.3	-	-	25.5	25.5	-	-	699.8	708.0	708.3
SAND/SALT BUILDING BORINGS										
SS-1	725.7	-	-	25.5	25.5	-	-	700.2	711.2	*
SS-2	725.5	-	-	16.5	16.5	-	-	709.0	711.0	DRY
PAVEMENT BORINGS										
P-1	725.8	-	3.0	7.5	10.5	-	-	715.3	DRY	DRY
P-2	725.2	-	-	10.5	10.5	-	-	714.7	DRY	DRY
BORING TOTALS:		1.5	11.0	134.5			0.0			

*Grouted Upon Completion

BY: MSL 05/17/18
CHK BY: RLD 05/18/18

**TABLE 2
SUMMARY OF SOIL LABORATORY TESTING
ERIE INTERNATIONAL AIRPORT
SNOW REMOVAL EQUIPMENT BUILDING
ERIE COUNTY, PENNSYLVANIA**

BORING NO.	SAMPLE NO.	SAMPLE DEPTH INTERVAL (feet)	MOISTURE CONTENT (%)	ATTERBURG LIMITS			AASHTO GRADATION					CLASSIFICATION		SPECIFIC GRAVITY	MOISTURE DENSITY RELATIONSHIP TEST (STANDARD PROCTOR)		CALIFORNIA BEARING RATIO TEST (CBR)	
				LL (%)	PL (%)	PI (%)	% ROCK FRAGS. OR GRAVEL	% SAND	% SILT	% CLAY	% TOTAL FINES	USCS	AASHTO		MAXIMUM DRY DENSITY (pcf)	OPT. MOISTURE CONTENT (%)	0.10 in. (%)	0.20 in. (%)
P-1	BS-1	0.0 - 6.0	12.0	26	17	9	7.1	25.7	26.9	40.3	67.2	CL	A-4(4)	2.85	117.9	16.0	4.6	4.1
P-2	BS-1	0.0 - 6.0	19.0	29	18	11	7.6	22.4	27.1	42.9	70.0	CL	A-6(6)	2.80	115.5	17.3	4.5	4.3
SRE-3	S-2 to S-6	3.0 - 10.5	19.5	NP	NP	NP	14.0	42.1	35.8	8.1	43.9	SM	A-4(0)	-	-	-	-	-
SRE-3	S-7 to S-8	12.0 - 16.5	28.1	NP	NP	NP	0.8	35.2	47.3	16.7	64.0	ML	A-4(0)	-	-	-	-	-
SS-1	S-2 to S-7	1.5 - 10.5	14.3	NP	NP	NP	1.3	49.2	41.6	7.9	49.5	SM	A-4(0)	-	-	-	-	-
SS-2	S-2 to S-7	1.5 - 10.5	10.1	NP	NP	NP	3.9	49.0	40.3	6.8	47.1	SM	A-4(0)	-	-	-	-	-

BY: MSL 05/17/18

CHK BY: RLD 05/18/18

APPENDIX A
ENGINEER'S FIELD BORING LOGS &
PAVEMENT CORE PHOTO

ENGINEER'S LOG

Boring **SRE-1** ECMS
 District: 1 County: Erie
 SR - _____ Section - _____
 Baseline: Erie International Airport
 Sta. _____ Offset _____
 Segment - _____ Offset - _____
 Coordinates:
 Lat. _____ Long. _____
1308743.8520 E 708113.1930 N
 Ground Elev. 725.0 ft.
 Water Level Elev./Elapsed Time:
 ▽ Initial 715.2 ft. Elapsed 0.0 hr.
 ▼ Final NR¹ Elapsed NR
 Driller: A. Sundberg
 Company: R. Rindfuss Drilling, L.P.

Drilling Start: 05/08/2018 10:30 am
 Drilling Complete: 05/08/2018 12:00 pm
 Grouting Complete: 05/08/2018 12:00 pm
 Rig: Simco 2800 Trailer
 Hammer Type: Safety
 SPT Hammer Efficiency:
 Assumed 0.6 Measured _____
 Hammer Calibration Date: _____
 Hole Type: Interval SPT
 Casing Type: Hollow Stem Auger
 Casing I.D.: 3.25 in Casing Depth: _____
 Rock Core Method: _____
 Inspector: Zachery Robertson
 Inspector Cert. No. 291-13



Final Log Checked and Approved
 By: Rochelle Dale
 Date: 5/21/2018

NOTE: N values and all graphical plots are for information only.

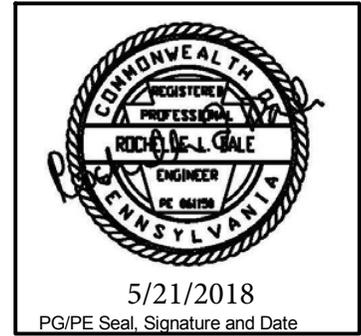
PENNDOT ENGINEER'S LOG - PENNDOT_GINT_VERSION_1.2.2.2_8-24-2016.GDT - 5/21/18 11:20 - L:\GINT\PROJECTS\2018\18056.GPJ

ELEV.	GRAPHIC	MATERIAL DESCRIPTION COMMENTS - OBSERVATIONS	AASHTO / USCS	SAMPLE DEPTH	SAMPLE No.	BLOW COUNTS (Blows/ 0.5ft)	N ₆₀ --- RQD %	REC (ft.)	REC (%)	◇ RQD % ◇	
										Soil/Rock Rec. %	▲ SPT (N ₆₀) ▲
		SAND , some Silt, loose, damp, homogeneous, poorly graded, brown, fill.			S-1	1-3-5	8	1.0	67		
		3.0'/El. 722.0	a-2-4 / sm	1.5	S-2	4-4-3	7	1.1	73		
		SAND , little Silt, trace Gravel, very loose to loose, wet to damp, homogeneous, poorly graded, brown, glacial till.			S-3	2-3-4	7	1.3	87		
720				3.0	S-4	2-2-3	5	1.3	87		
				4.5	S-5	3-5-4	9	1.2	80		
			a-1-b / sp	6.0	S-6	2-2-2	4	1.4	93		
				7.5	S-7	3-3-7	10	1.5	100		
715				9.0							
				10.5							
		12.0'/El. 713.0		12.0	S-8	1-2-3 Pen=1.00 tsf	5	1.5	100		
		SILT , trace Sand, soft to medium, wet, homogeneous, low plastic fines, brown, glacial till.	a-4 / ml	13.5							

ENGINEER'S LOG

Boring **SRE-2** ECMS
 District: 1 County: Erie
 SR - _____ Section - _____
 Baseline: Erie International Airport
 Sta. _____ Offset _____
 Segment - _____ Offset - _____
 Coordinates:
 Lat. _____ Long. _____
1308759.3810 E 708320.2240 N
 Ground Elev. 726.2 ft.
 Water Level Elev./Elapsed Time:
 ▽ Initial 709.2 ft. Elapsed 0.0 hr.
 ▼ Final NR¹ Elapsed NR
 Driller: A. Sundberg
 Company: R. Rindfuss Drilling, L.P.

Drilling Start: 05/08/2018 8:30 am
 Drilling Complete: 05/08/2018 10:00 am
 Grouting Complete: 05/08/2018 10:00 am
 Rig: Simco 2800 Trailer
 Hammer Type: Safety
 SPT Hammer Efficiency:
 Assumed 0.6 Measured _____
 Hammer Calibration Date: _____
 Hole Type: Interval SPT
 Casing Type: Hollow Stem Auger
 Casing I.D.: 3.25 in Casing Depth: _____
 Rock Core Method: _____
 Inspector: Zachery Robertson
 Inspector Cert. No. 291-13



Final Log Checked and Approved
 By: Rochelle Dale
 Date: 5/21/2018

NOTE: N values and all graphical plots are for information only.

PENNDOT ENGINEERS LOG - PENNDOT_GINT_VERSION_1.2.2.2_8-24-2016.GDT - 5/21/18 11:20 - L:\GINT\PROJECTS\2018\18056.GPJ

ELEV.	GRAPHIC	MATERIAL DESCRIPTION COMMENTS - OBSERVATIONS	AASHTO / USCS	SAMPLE DEPTH	SAMPLE No.	BLOW COUNTS (Blows/ 0.5ft)	N ₆₀ --- RQD %	REC (ft.)	REC (%)	◇ RQD % ◇			
										Soil/Rock Rec. %	Soil/Rock Rec. %		
										▲ SPT (N ₆₀) ▲			
										10	20	30	40
725		SAND , some Gravel, little Silt, medium dense, damp, homogeneous, well graded, angular, brown, fill. SAND , little Silt, trace Gravel, loose to medium dense, wet to damp, homogeneous, poorly graded, brown and gray, glacial till.	a-1-b / sw	1.5	S-1	3-8-6	14	0.5	33				
					3.5'/El. 722.7	S-2	7-11-13	24	1.2	80			
720				3.0	S-3	7-10-5	15	1.5	100				
				4.5	S-4	4-4-4	8	1.1	73				
				6.0	S-5	6-7-8	15	1.1	73				
				7.5	S-6	5-9-8	17	1.3	87				
				9.0	S-7	7-7-8	15	1.2	80				
715			a-2-4 / sm	10.5									
				12.0	S-8	3-6-5	11	1.5	100				
				13.5									

ENGINEER'S LOG

Boring **SRE-2** ECMS

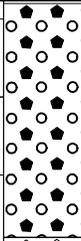
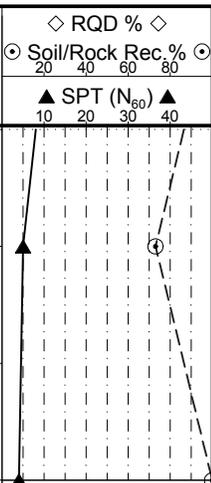
District: 1 County: Erie

Sheet 2 of 2

SR - _____ Section - _____

NOTE: N values and all graphical plots are for information only.

Sta. _____ Offset _____

ELEV.	GRAPHIC	MATERIAL DESCRIPTION COMMENTS - OBSERVATIONS	AASHTO / USCS	SAMPLE DEPTH	SAMPLE No.	BLOW COUNTS (Blows/ 0.5ft)	N ₆₀ --- RQD %	REC (ft.)	REC (%)	Soil/Rock Rec. %	
										◇ RQD % ◇	▲ SPT (N ₆₀) ▲
710		SAND , little Silt, trace Gravel, loose to medium dense, wet to damp, homogeneous, poorly graded, brown and gray, glacial till. <i>(Layer continued from the previous page.)</i>	a-2-4 / sm	15.0	S-9	2-2-3	5	1.1	73		
		18.0'/El. 708.2		16.5							
			a-4 / ml	18.0	S-10	2-2-2 Pen=0.75 tsf	4	1.5	100		
705		Bottom of boring.								<p>¹24-hr. Water: Boring grouted upon completion.</p>	
700											
695											

PENNDOT ENGINEER'S LOG - PENNDOT_GINT_VERSION_1.2.2.2_8-24-2016.GDT - 5/21/18 11:20 - L:\GINT\PROJECTS\2018\18056.GPJ

ENGINEER'S LOG

Boring **SRE-3** ECMS
 District: 1 County: Erie
 SR - _____ Section - _____
 Baseline: Erie International Airport
 Sta. _____ Offset _____
 Segment - _____ Offset - _____
 Coordinates:
 Lat. _____ Long. _____
1308803.8760 E 708093.5480 N
 Ground Elev. 725.8 ft.
 Water Level Elev./Elapsed Time:
 ▽ Initial 715.3 ft. Elapsed 0.0 hr.
 ▼ Final NR¹ Elapsed NR
 Driller: A. Sundberg
 Company: R. Rindfuss Drilling, L.P.

Drilling Start: 05/08/2018 1:00 pm
 Drilling Complete: 05/08/2018 2:30 pm
 Grouting Complete: 05/08/2018 2:30 pm
 Rig: Simco 2800 Trailer
 Hammer Type: Safety
 SPT Hammer Efficiency:
 Assumed 0.6 Measured _____
 Hammer Calibration Date: _____
 Hole Type: Interval SPT
 Casing Type: Hollow Stem Auger
 Casing I.D.: 3.25 in Casing Depth: _____
 Rock Core Method: _____
 Inspector: Zachery Robertson
 Inspector Cert. No. 291-13



Final Log Checked and Approved
 By: Rochelle Dale
 Date: 5/21/2018

Lab Testing Performed on Sample
 NOTE: N values and all graphical plots are for information only.

PENNDOT ENGINEERS LOG - PENNDOT_GINT_VERSION_1.2.2.2_8-24-2016.GDT - 5/21/18 11:20 - L:\GINT\PROJECTS\2018\18056.GPJ

ELEV.	GRAPHIC	MATERIAL DESCRIPTION COMMENTS - OBSERVATIONS	AASHTO / USCS	SAMPLE DEPTH	SAMPLE No.	BLOW COUNTS (Blows/ 0.5ft)	N ₆₀ --- RQD %	REC (ft.)	REC (%)	◇ RQD % ◇			
										Soil/Rock	Rec. %		
										⊙ Soil/Rock Rec. % ⊙			
										▲ SPT (N ₆₀) ▲			
										10	20	30	40
725		BITUMINOUS CONCRETE. 0.5'/El. 725.3			PC-1			0.4	27				
		GRAVEL , subbase. 1.5'/El. 724.3		1.5									
		SAND , some Gravel, trace Silt, medium dense, moist, homogeneous, well graded, angular, brown, fill. 3.0'/El. 722.8	a-1-b / sw	3.0	S-1	4-8-5	13	1.2	80				
		SAND and SILT , little Gravel, trace Clay, very loose to loose, wet to moist, homogeneous, poorly graded, brown, glacial till. <i>Classification on S-2 to S-6 (3.0-10.5'), N.M.C. = 19.5%.</i>		4.5	S-2	3-3-4	7	1.4	93				
720				6.0	S-3	2-1-1	2	1.1	73				
			A-4 / SM	7.5	S-4	2-3-3	6	1.2	80				
				9.0	S-5	2-3-4	7	1.2	80				
				10.5	S-6	5-2-3	5	1.5	100				
715		SILT and SAND , little Clay, trace Gravel, medium to stiff, wet, lensed, non-plastic, gray, glacial till. <i>Classification on S-7 to S-8 (12.0-16.5'), N.M.C. = 28.1%.</i>		12.0	S-7	1-2-3 Pen=1.00 tsf	5	1.2	80				
			A-4 / ML	13.5									

ENGINEER'S LOG

Boring **SRE-3** ECMS

District: 1 County: Erie

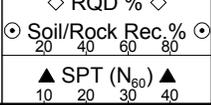
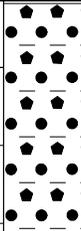
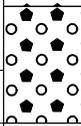
Sheet 2 of 2

SR - _____ Section - _____

Sta. _____ Offset _____

NOTE: N values and all graphical plots are for information only.

 Lab Testing Performed on Sample

ELEV.	GRAPHIC	MATERIAL DESCRIPTION COMMENTS - OBSERVATIONS	AASHTO / USCS	SAMPLE DEPTH	SAMPLE No.	BLOW COUNTS (Blows/0.5ft)	N ₆₀ --- RQD %	REC (ft.)	REC (%)	◇ RQD % ◇	
										Soil/Rock Rec. %	Rec. %
											
710		SILT and SAND , little Clay, trace Gravel, medium to stiff, wet, lensed, non-plastic, gray, glacial till. <i>(Layer continued from the previous page.)</i> S-8 contains more clay than S-7.	A-4 / ML	15.0	S-8	3-4-5 Pen=2.00 tsf	9	1.5	100		
		18.0'/El. 707.8		16.5							
		SAND , trace Silt, loose, wet, homogeneous, poorly graded, gray, glacial till.	a-1-b / sp	18.0	S-9	3-6-4	10	1.1	73		
		19.5'/El. 706.3									
705		Bottom of boring.									
											¹ 24-hr. Water: Boring grouted upon completion.
700											
695											

PENNDOT ENGINEERS LOG - PENNDOT_GINT_VERSION_1.2.2.2_8-24-2016.GDT - 5/21/18 11:20 - L:\GINT\PROJECTS\2018\18056.GPJ

ENGINEER'S LOG

Boring **SRE-4** ECMS

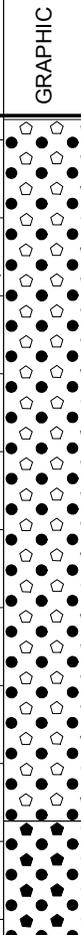
District: 1 County: Erie

Sheet 2 of 2

SR - _____ Section - _____

NOTE: N values and all graphical plots are for information only.

Sta. _____ Offset _____

ELEV.	GRAPHIC	MATERIAL DESCRIPTION COMMENTS - OBSERVATIONS	AASHTO / USCS	SAMPLE DEPTH	SAMPLE No.	BLOW COUNTS (Blows/ 0.5ft)	N ₆₀ --- RQD %	REC (ft.)	REC (%)	Soil/Rock Rec. %			
										◇ RQD % ◇	▲ SPT (N ₆₀) ▲		
											<div style="display: flex; justify-content: space-between; width: 100%;"> 20 40 60 80 </div> <div style="display: flex; justify-content: space-between; width: 100%;"> 10 20 30 40 </div>		
710		SILT and fine SAND , soft to medium, wet, lensed, low plastic fines, gray, glacial till.		15.0	S-9	1-1-2 Pen=0.25 tsf	3	1.0	67				
				16.5									
				18.0			S-10	1-2-2 Pen=0.50 tsf	4	1.5	100		
				19.5		a-4 / ml							
				21.0			S-11	1-2-6 Pen=1.00 tsf	8	1.3	87		
705		24.0'/El. 701.3		22.5									
		SAND and SILT , dense, wet, lensed, poorly graded, gray, glacial till.	a-2-4 / sm	24.0	S-12	11-20-26	46	1.5	100				
700	25.5'/El. 699.8												
		Bottom of boring.											
695													

PENNDOT ENGINEERS LOG - PENNDOT_GINT_VERSION_1.2.2.2_8-24-2016.GDT - 5/21/18 11:20 - L:\GINT\PROJECTS\2018\18056.GPJ

ENGINEER'S LOG

Boring **SS-1** ECMS

District: 1 County: Erie

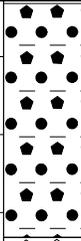
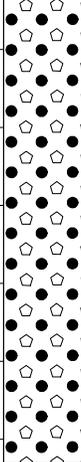
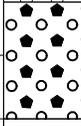
Sheet 2 of 2

SR - _____ Section - _____

Sta. _____ Offset _____

NOTE: N values and all graphical plots are for information only.

Lab Testing Performed on Sample

ELEV.	GRAPHIC	MATERIAL DESCRIPTION COMMENTS - OBSERVATIONS	AASHTO / USCS	SAMPLE DEPTH	SAMPLE No.	BLOW COUNTS (Blows/ 0.5ft)	N ₆₀ --- RQD %	REC (ft.)	REC (%)	Soil/Rock Rec. %		
										Soil	Rock	
710		SAND and SILT , trace Clay, trace Gravel, very loose to loose, wet to dry, homogeneous, poorly graded, brown, glacial till. <i>(Layer continued from the previous page.)</i>	A-4 / SM	15.0	S-9	1-2-1	3	0.4	27			
16.5												
			18.0'/El. 707.7		18.0	S-10	1-1-1 Pen=0.50 tsf	2	1.5	100		
705		SILT , little fine Sand, very soft to medium, wet, homogeneous, low plastic fines, gray, glacial till.	a-4 / ml	19.5								
21.0												
22.5												
		24.0'/El. 701.7		24.0	S-11	2-2-4 Pen=1.00 tsf	6	1.5	100			
700		SAND , little Silt, loose, wet, homogeneous, poorly graded, gray, glacial till.	a-2-4 / sm	24.0	S-12	2-4-5	9	1.5	100			
					25.5'/El. 700.2							
695		Bottom of boring.										

PENNDOT ENGINEERS LOG - PENNDOT_GINT_VERSION_1.2.2.2_8-24-2016.GDT - 5/21/18 11:20 - L:\GINT\PROJECTS\2018\18056.GPJ

¹24-hr. Water: Boring grouted upon completion.

ENGINEER'S LOG

Boring **SS-2** ECMS
 District: 1 County: Erie
 SR - _____ Section - _____
 Baseline: Erie International Airport
 Sta. _____ Offset _____
 Segment - _____ Offset - _____
 Coordinates:
 Lat. _____ Long. _____
1308892.3160 E 708485.6900 N
 Ground Elev. 725.5 ft.
 Water Level Elev./Elapsed Time:
 ▽ Initial 711.0 ft. Elapsed 0.0 hr.
 ▼ Final Dry Elapsed 28.8 hr.
 Driller: A. Sundberg
 Company: R. Rindfuss Drilling, L.P.

Drilling Start: 05/07/2018 9:45 am
 Drilling Complete: 05/07/2018 10:45 am
 Grouting Complete: 05/08/2018 3:30 pm
 Rig: Simco 2800 Trailer
 Hammer Type: Safety
 SPT Hammer Efficiency:
 Assumed 0.6 Measured _____
 Hammer Calibration Date: _____
 Hole Type: Interval SPT
 Casing Type: Hollow Stem Auger
 Casing I.D.: 3.25 in Casing Depth: _____
 Rock Core Method: _____
 Inspector: Zachery Robertson
 Inspector Cert. No. 291-13



Final Log Checked and Approved
 By: Rochelle Dale
 Date: 5/21/2018

Lab Testing Performed on Sample
 NOTE: N values and all graphical plots are for information only.

ELEV.	GRAPHIC	MATERIAL DESCRIPTION COMMENTS - OBSERVATIONS	AASHTO / USCS	SAMPLE DEPTH	SAMPLE No.	BLOW COUNTS (Blows/ 0.5ft)	N ₆₀ --- RQD %	REC (ft.)	REC (%)	◇ RQD % ◇					
										Soil/Rock Rec. %	Soil/Rock Rec. %				
										▲ SPT (N ₆₀) ▲					
										10	20	30	40		
725		SAND and SILT , trace Clay, trace Gravel, loose to medium dense, wet to dry, homogeneous, poorly graded, rounded, brown and gray, glacial till. <i>Classification on S-2 to S-7 (1.5-10.5'), N.M.C. = 10.1%.</i>	A-4 / SM	1.5	S-1	1-4-8	12	1.2	80						
				3.0	S-2	12-8-5	13	1.0	67						
				4.5	S-3	5-6-6	12	1.1	73						
				6.0	S-4	21-5-7	12	1.1	73						
				7.5	S-5	5-6-4	10	0.9	60						
				9.0	S-6	5-3-3	6	0.8	53						
				10.5	S-7	3-3-3	6	0.6	40						
				12.0	S-8	3-2-3	5	0.8	53						
				13.5											

PENNDOT ENGINEERS LOG - PENNDOT_GINT_VERSION_1.2.2.2_8-24-2016.GDT - 5/21/18 11:20 - L:\GINT\PROJECTS\2018\18056.GPJ

ENGINEER'S LOG

Boring **SS-2** ECMS

District: 1 County: Erie

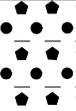
Sheet 2 of 2

SR - _____ Section - _____

Sta. _____ Offset _____

NOTE: N values and all graphical plots are for information only.

 Lab Testing Performed on Sample

ELEV.	GRAPHIC	MATERIAL DESCRIPTION COMMENTS - OBSERVATIONS	AASHTO / USCS	SAMPLE DEPTH	SAMPLE No.	BLOW COUNTS (Blows/ 0.5ft)	N ₆₀ --- RQD %	REC (ft.)	REC (%)	◇ RQD % ◇	
										Soil/Rock Rec. %	Soil/Rock Rec. %
											▲ SPT (N ₆₀) ▲ 10 20 30 40
710		16.5'/El. 709.0	A-4 / SM	15.0	S-9	2-2-3	5	0.4	27	◇ RQD % ◇ 20 40 60 80	▲ SPT (N ₆₀) ▲ 10 20 30 40
		Bottom of boring.									▲ SPT (N ₆₀) ▲ 10 20 30 40
705											
700											
695											

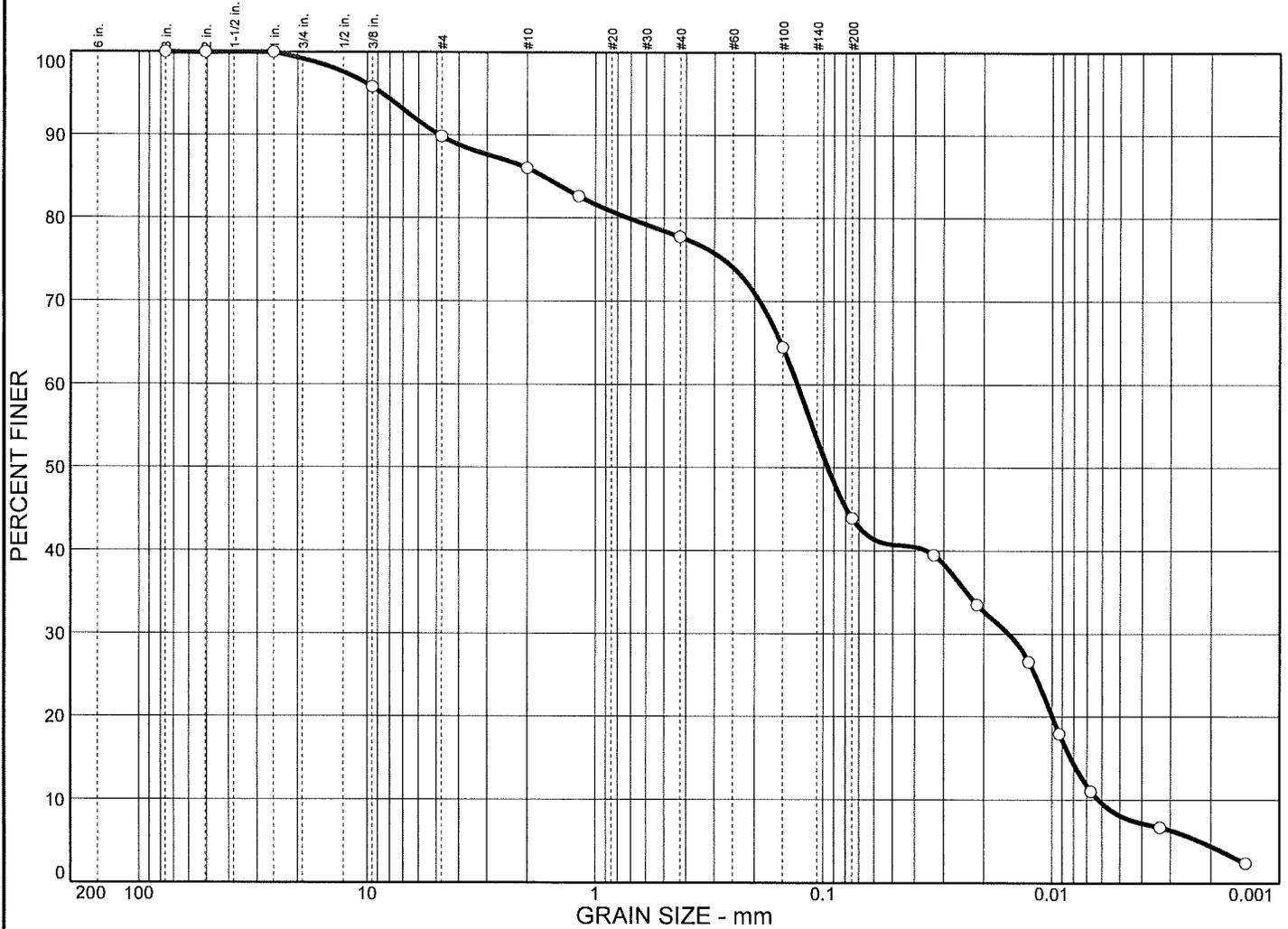
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Boring: SRE-3, Pavement Core

APPENDIX B
LABORATORY SOIL TEST RESULTS

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY					
0.0	14.0	42.1	35.8	8.1					
LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
NP	NP	1.69	0.129	0.0955	0.0156	0.0083	0.0062	0.30	20.79

MATERIAL DESCRIPTION	USCS	AASHTO
○ Silty Sand	SM	A-4(0)

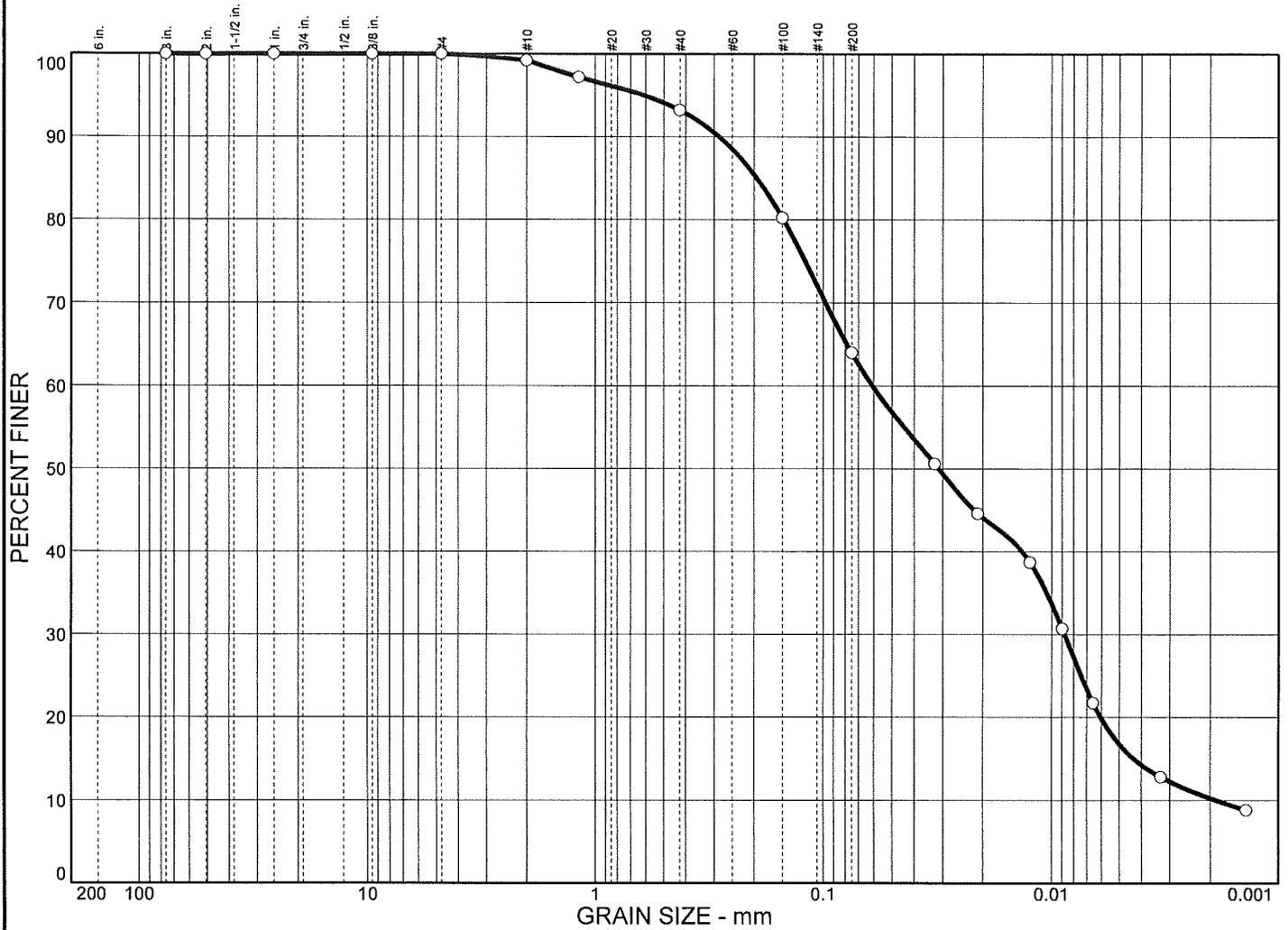
Project No. 18056 **Client:** Michael Baker
Project: ERAA
 ○ **Location:** SRE-3, S-2,3,4,5,6, 3.0 - 10.5 ft

PARTICLE SIZE DISTRIBUTION TEST REPORT

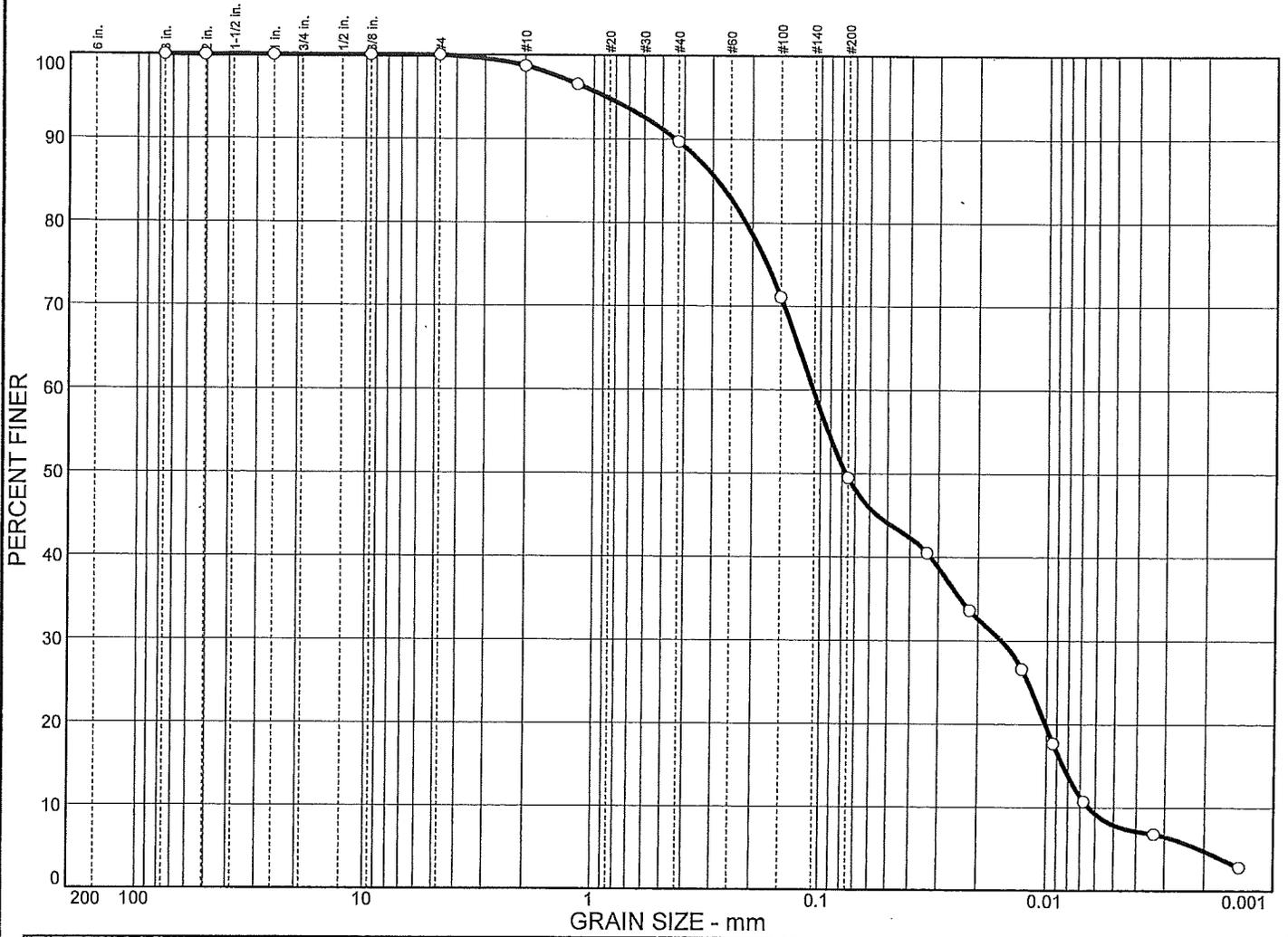
American Geotechnical & Environmental Services, Inc.

Remarks:
 ○ Lab Sample #18393
 N.M.C. = 19.5%
 Composite Jar Sample
 May 2018

PARTICLE SIZE DISTRIBUTION TEST REPORT



PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	1.3	49.2	41.6	7.9

	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
X	NP	NP	0.285	0.107	0.0767	0.0158	0.0084	0.0064	0.36	16.78

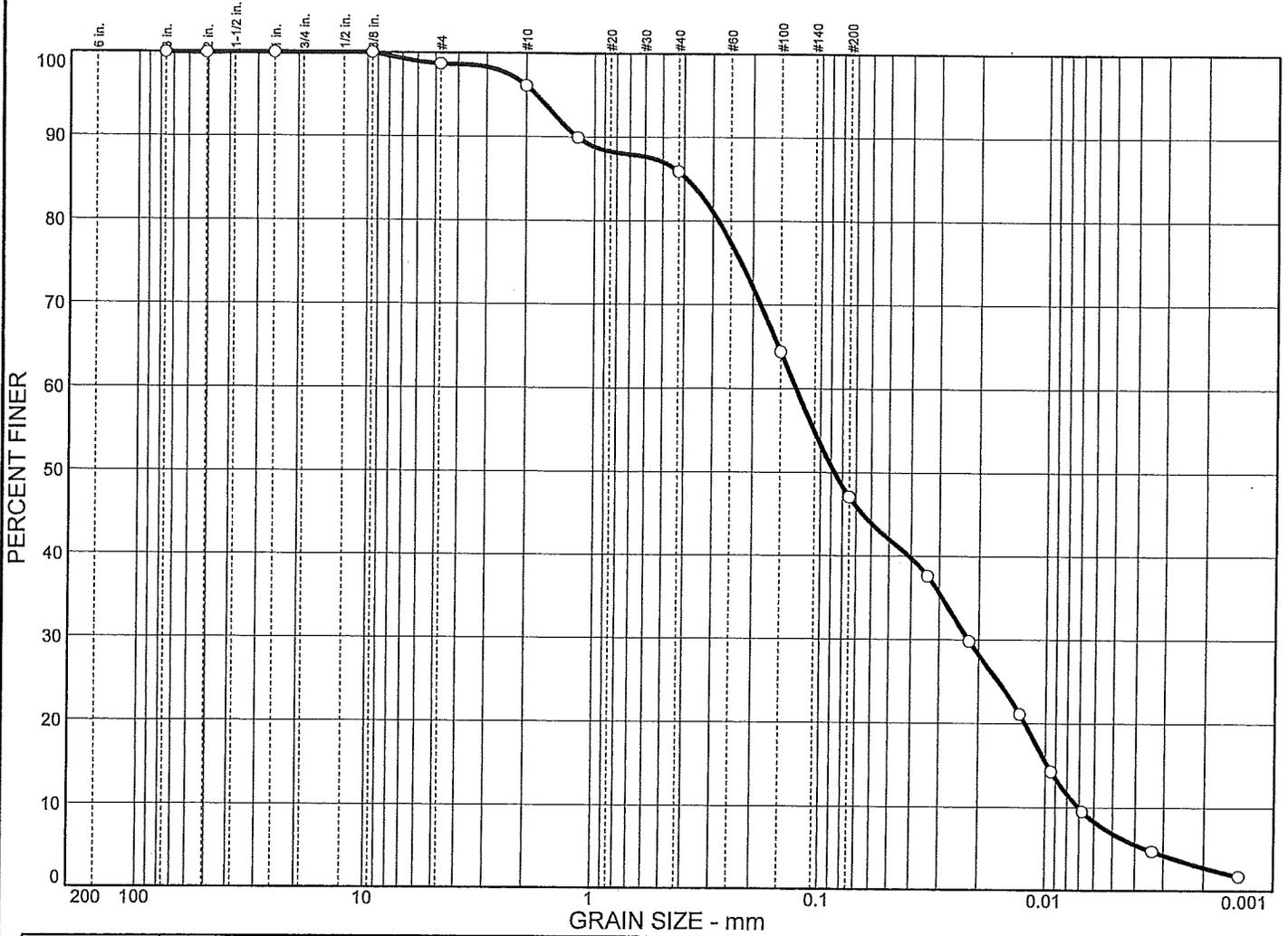
MATERIAL DESCRIPTION	USCS	AASHTO
○ Silty Sand	SM	A-4(0)

Project No. 18056 **Client:** Michael Baker
Project: ERAA
 ○ **Location:** SS-1, S-2,3,4,5,6,7, 1.5 - 10.5 ft

Remarks:
 ○ Lab Sample #18391
 N.M.C. = 14.3%
 Composite Jar Sample

 May 2018

PARTICLE SIZE DISTRIBUTION TEST REPORT



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	3.9	49.0	40.3	6.8

LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
NP	NP	0.390	0.128	0.0868	0.0223	0.0098	0.0071	0.55	18.13

MATERIAL DESCRIPTION	USCS	AASHTO
Silty Sand	SM	A-4(0)

<p>Project No. 18056 Client: Michael Baker</p> <p>Project: ERAA</p> <p>Location: SS-2, S-2,3,4,5,6,7, 1.5 - 10.5 ft</p>	<p>Remarks:</p> <p>○ Lab Sample #18392 N.M.C. = 10.1% Composite Jar Sample</p> <p style="text-align: center;">May 2018</p>
<p>PARTICLE SIZE DISTRIBUTION TEST REPORT</p> <p>American Geotechnical & Environmental Services, Inc.</p>	

PARTICLE SIZE DISTRIBUTION TEST REPORT



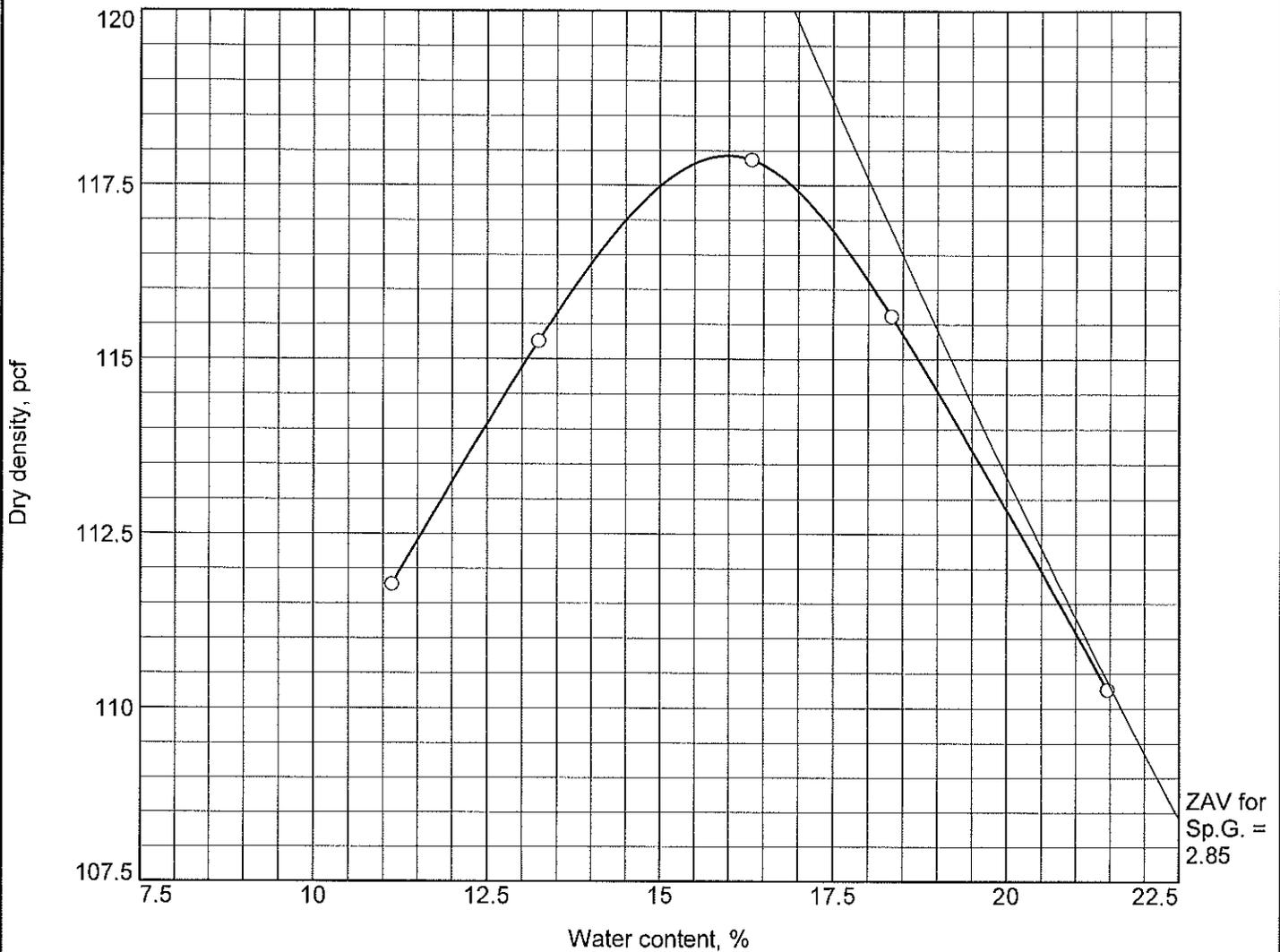
% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	7.1	25.7	26.9	40.3

LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
26	17	0.796	0.0441	0.0102	0.0018				

MATERIAL DESCRIPTION	USCS	AASHTO
○ Sandy Clay	CL	A-4(4)

<p>Project No. 18056 Client: Michael Baker</p> <p>Project: ERAA</p> <p>○ Location: P-1, BS-1, 0.0 - 6.0 ft</p>	<p>Remarks:</p> <p>○ Lab Sample #18389</p> <p>N.M.C. = 12.0%</p> <p>Bag Sample</p> <p>May 2018</p>
<p>PARTICLE SIZE DISTRIBUTION TEST REPORT</p> <p>American Geotechnical & Environmental Services, Inc.</p>	

COMPACTION TEST REPORT



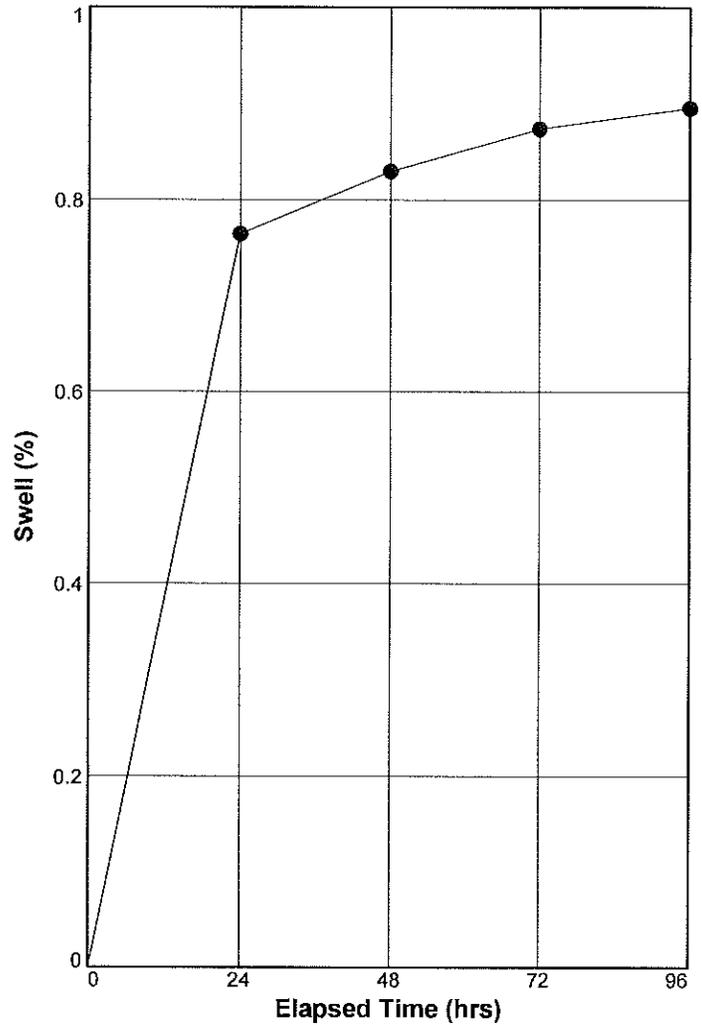
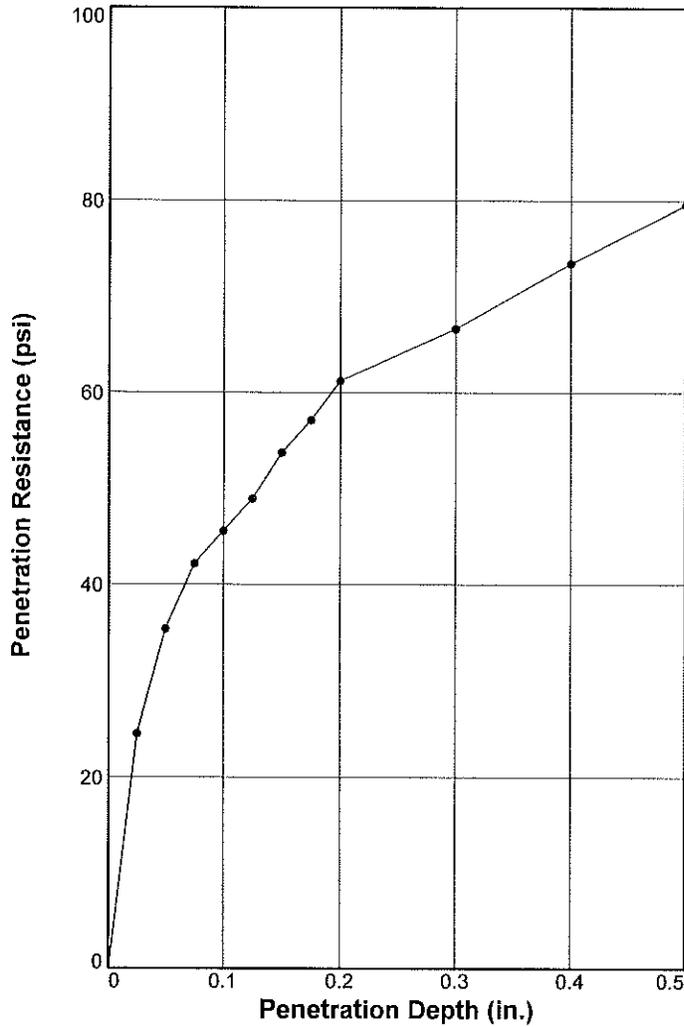
Test specification: ASTM D 1557-07 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
	CL	A-4(4)	12.0	2.85	26	9	0.0	67.2

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 117.9 pcf Optimum moisture = 16.0 %	Sandy Clay
Project No. 18056 Client: Michael Baker Project: ERAA ○ Location: P-1, BS-1, 0.0 - 6.0 ft Sample Number: #18389	Remarks: Lab Sample #18389 N.M.C. = 12.0% Bag Sample May 2018
American Geotechnical & Environmental Services, Inc.	Figure

BEARING RATIO TEST REPORT

AASHTO T 193-99



	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ●	116.1	98.5	15.8	115.1	97.6	17.3	4.6	4.1	0.000	40	0.9
2 ▲											
3 ■											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
	Sandy Clay	CL	117.9	16.0	26

Project No: 18056
Project: ERAA
Location: P-1, BS-1, 0.0 - 6.0 ft
Sample Number: #18389
Date:

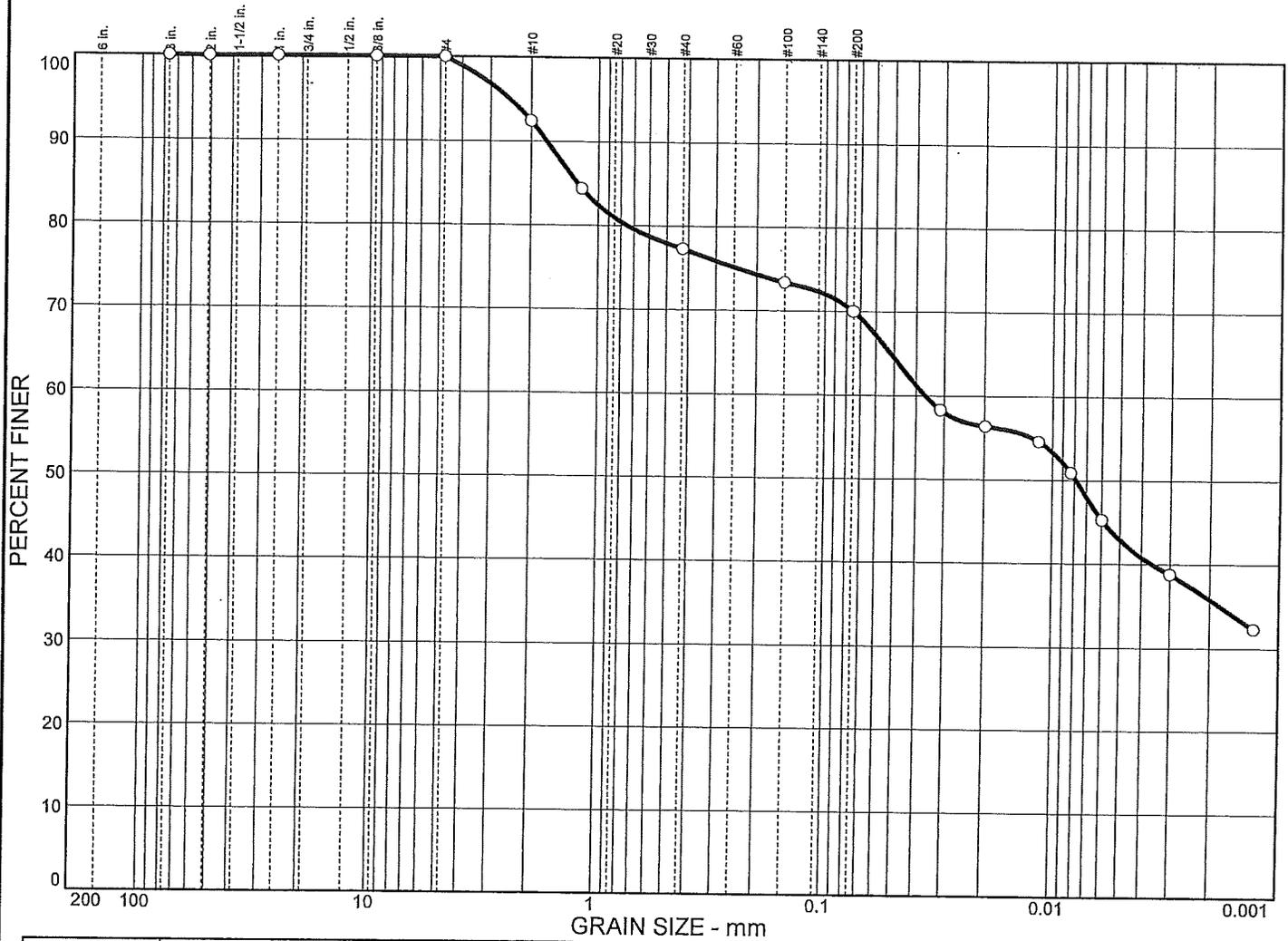
Test Description/Remarks:
 AASHTO T-193
 Lab Sample #18389
 N.M.C. = 12.0%
 Bag Sample

BEARING RATIO TEST REPORT
 American Geotechnical & Environmental Services, Inc.

May 2018

Figure _____

PARTICLE SIZE DISTRIBUTION TEST REPORT



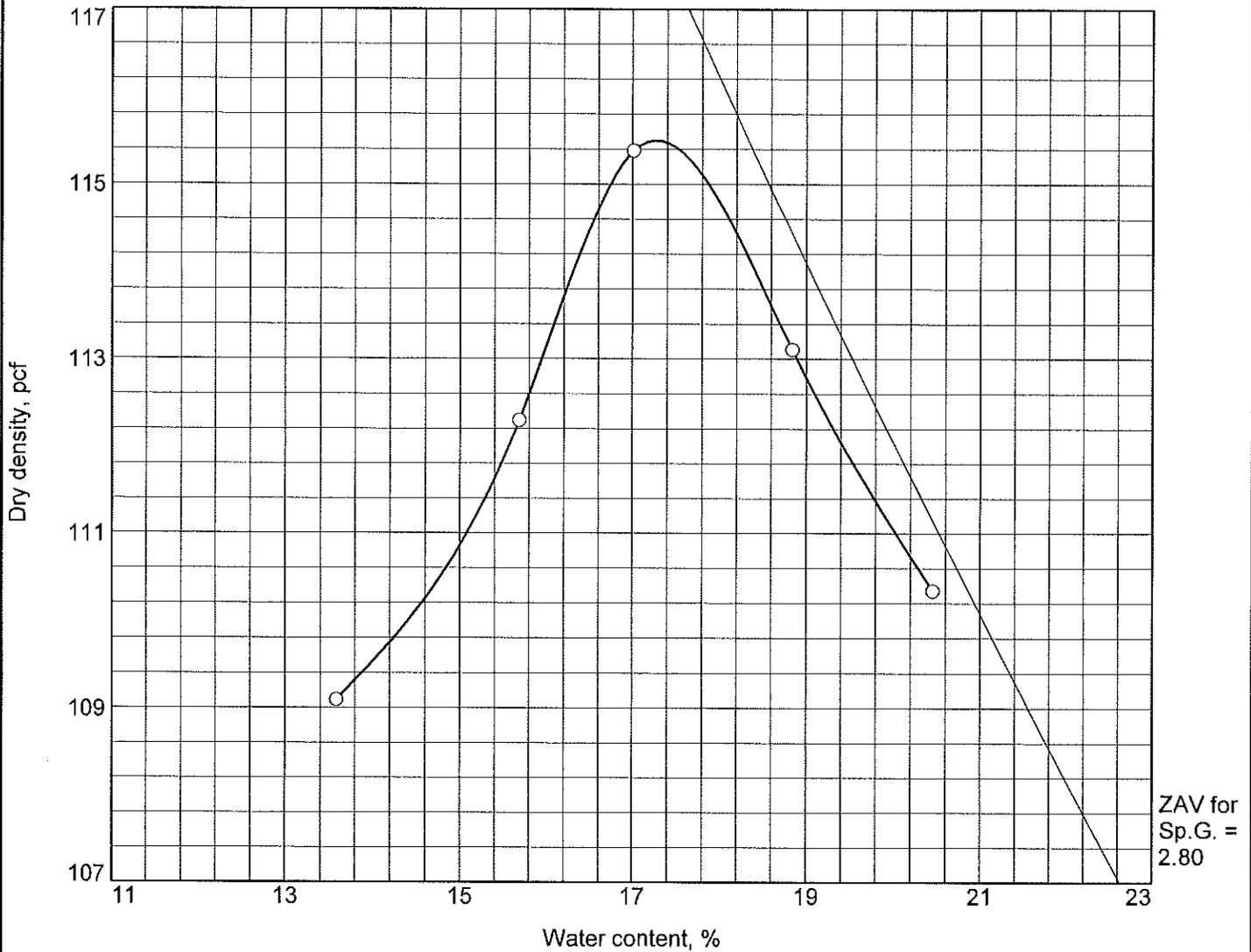
% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	7.6	22.4	27.1	42.9

LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
29	18	1.23	0.0365	0.0078					

MATERIAL DESCRIPTION	USCS	AASHTO
○ Sandy Clay	CL	A-6(6)

<p>Project No. 18056 Client: Michael Baker</p> <p>Project: ERAA</p> <p>○ Location: P-2, BS-1, 0.0 - 6.0 ft</p>	<p>Remarks:</p> <p>○ Lab Sample #18390</p> <p>N.M.C. = 19.0%</p> <p>Bag Sample</p> <p>May 2018</p>
<p>PARTICLE SIZE DISTRIBUTION TEST REPORT</p> <p>American Geotechnical & Environmental Services, Inc.</p>	

COMPACTION TEST REPORT



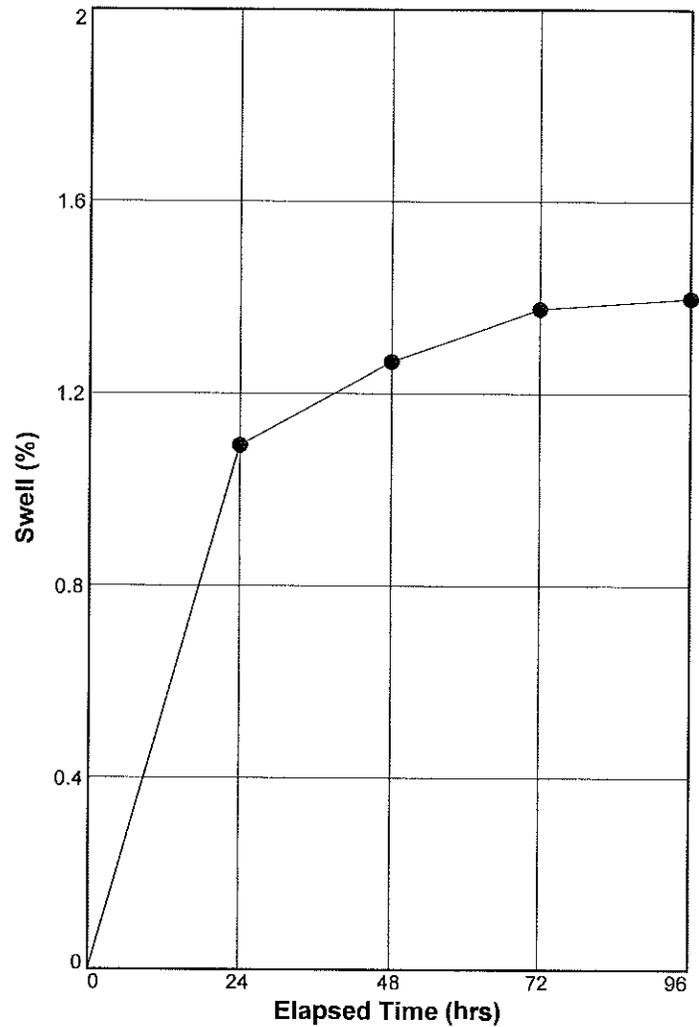
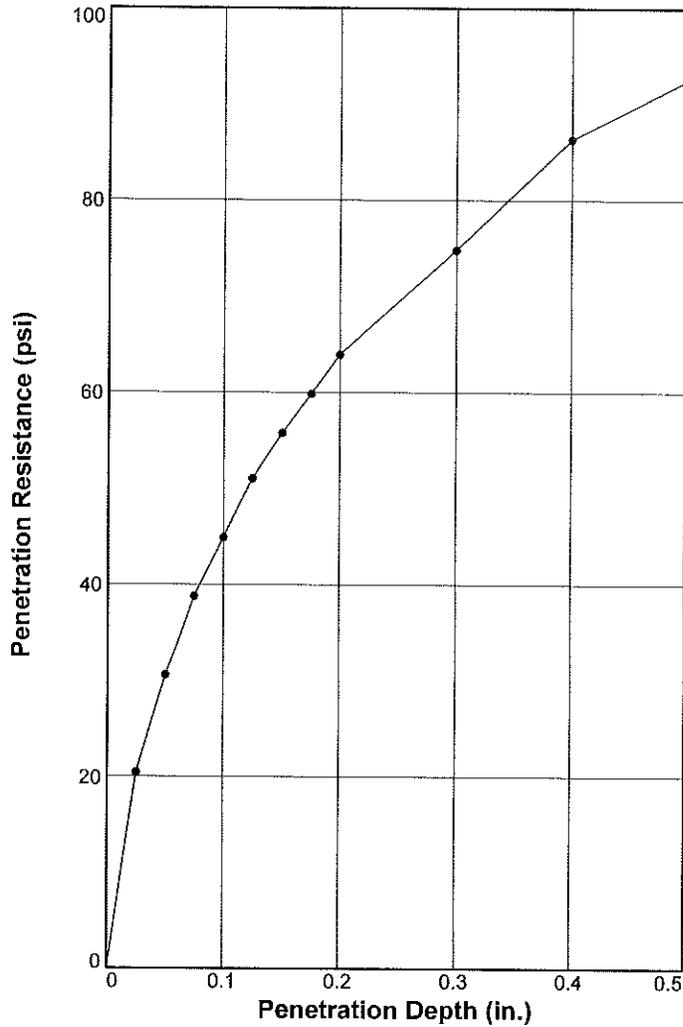
Test specification: ASTM D 1557-07 Method C Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
	CL	A-6(6)	19.0	2.80	29	11	0.0	70.0

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 115.5 pcf Optimum moisture = 17.3 %	Sandy Clay
Project No. 18056 Client: Michael Baker Project: ERAA ○ Location: P-2, BS-1, 0.0 - 6.0 ft Sample Number: #18390	Remarks: Lab Sample #18390 N.M.C. = 19.0% Bag Sample May 2018
American Geotechnical & Environmental Services, Inc.	Figure

BEARING RATIO TEST REPORT

AASHTO T 193-99



	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ●	113.2	98	16.8	111.7	96.7	19.7	4.5	4.3	0.000	40	1.4
2 ▲											
3 ■											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Sandy Clay	CL	115.5	17.3	29	11

Project No: 18056
Project: ERAA
Location: P-2, BS-1, 0.0 - 6.0 ft
Sample Number: #18390
Date:

Test Description/Remarks:

Lab Sample #18390
 N.M.C. = 19.0%
 Bag Sample

May 2018

APPENDIX C
PLOTTED BORING LOGS

GENERAL NOTES

THIS SHEET IS INCLUDED FOR THE CONVENIENCE OF THE DEPARTMENT. REFER TO PUBLICATION 408 SECTION 102.05 FOR FURTHER INFORMATION.

FOR ADDITIONAL SOIL AND ROCK DESCRIPTIONS SEE PUBLICATION 222.

THE BORING LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED. SUBSURFACE CONDITIONS MAY DIFFER FROM THE CONDITIONS REPORTED AT THE SPECIFIC LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE OF CONDITIONS AT THE BORING LOCATIONS.

LEGEND

- PP POCKET PENETROMETER
- TOR TOP OF ROCK ELEVATION
- BFE BOTTOM OF FOOTING ELEVATION

THE DESCRIPTION OF THE MATERIALS ENCOUNTERED HAVE BEEN VERIFIED.
OFF

SUBSTRUCTURE UNIT: SNOW REMOVAL EQUIPMENT BUILDING												LOG 1 OF 1											
BORING NUMBER: SRE-1				BORING LOCATION STATION: OFFSET:				START: 05/08/2018 10:30 AM				HAMMER: SAFETY											
								FINISH: 05/08/2018 12:00 PM				EFFICIENCY: 0.6 ERa											
DRILLING METHOD AND EQUIPMENT: -, SAFETY, SIMCO 2800 TRAILER						SIZE OF CORE: "NO RECORD"		VERTICAL SCALE: 0 FT. 5 FT.		TOP OF BORING ELEVATION: 725.0 FT.													
DRILLING INSPECTOR: ZACHERY ROBERTSON DRILLER & DRILLING COMPANY: A. SUNDBERG R. RINDFUSS DRILLING, L.P.						∇ 0 HR. READING - ELAPSED TIME: EI. 715.2 ft. - 0.0 hr. ▼ 24 HR. READING - ELAPSED TIME: NR - NR ¹																	
ELEV.	GRAPHIC	MATERIAL DESCRIPTION	AASHTO/USCS	SAMPLE DEPTH	SAMPLE NO.	BLOW COUNT	PPT TSF	N ₆₀ / %RQD	REC (ft.)	REC (%)	RQD %												
											Soil/Rock Rec. %	SPT (N ₆₀)											
											10	20	30	40									
725		SAND, some Silt, loose, damp, homogeneous, poorly graded, brown, fill. 3.0'/EI. 722.0	a-2-4 / sm	1.5	S-1	1-3-5	8	1.0	67														
				3.0	S-2	4-4-3	7	1.1	73														
				4.5	S-3	2-3-4	7	1.3	87														
				6.0	S-4	2-2-3	5	1.3	87														
				7.5	S-5	3-5-4	9	1.2	80														
				9.0	S-6	2-2-2	4	1.4	93														
				10.5	S-7	3-3-7	10	1.5	100														
				12.0	S-8	1-2-3 1.00	5	1.5	100														
				13.5	S-9	2-2-2 1.00	4	1.5	100														
				15.0	S-10	3-4-4	8	1.2	80														
				16.5																			
				18.0																			
				19.5																			

¹24-hr. Water: Boring grouted upon completion.

SUBSTRUCTURE UNIT: SNOW REMOVAL EQUIPMENT BUILDING												LOG 1 OF 1											
BORING NUMBER: SRE-2				BORING LOCATION STATION: OFFSET:				START: 05/08/2018 8:30 AM				HAMMER: SAFETY											
								FINISH: 05/08/2018 10:00 AM				EFFICIENCY: 0.6 ERa											
DRILLING METHOD AND EQUIPMENT: -, SAFETY, SIMCO 2800 TRAILER						SIZE OF CORE: "NO RECORD"		VERTICAL SCALE: 0 FT. 5 FT.		TOP OF BORING ELEVATION: 726.2 FT.													
DRILLING INSPECTOR: ZACHERY ROBERTSON DRILLER & DRILLING COMPANY: A. SUNDBERG R. RINDFUSS DRILLING, L.P.						∇ 0 HR. READING - ELAPSED TIME: EI. 709.2 ft. - 0.0 hr. ▼ 24 HR. READING - ELAPSED TIME: NR - NR ¹																	
ELEV.	GRAPHIC	MATERIAL DESCRIPTION	AASHTO/USCS	SAMPLE DEPTH	SAMPLE NO.	BLOW COUNT	PPT TSF	N ₆₀ / %RQD	REC (ft.)	REC (%)	RQD %												
											Soil/Rock Rec. %	SPT (N ₆₀)											
											10	20	30	40									
725		SAND, some Gravel, little Silt, medium dense, damp, homogeneous, well graded, angular, brown, fill. 3.5'/EI. 722.7	a-1-b / sw	1.5	S-1	3-8-6	14	0.5	33														
				3.0	S-2	7-11-13	24	1.2	80														
				4.5	S-3	7-10-5	15	1.5	100														
				6.0	S-4	4-4-4	8	1.1	73														
				7.5	S-5	6-7-8	15	1.1	73														
				9.0	S-6	5-9-8	17	1.3	87														
				10.5	S-7	7-7-8	15	1.2	80														
				12.0	S-8	3-6-5	11	1.5	100														
				13.5	S-9	2-2-3	5	1.1	73														
				15.0	S-10	2-2-2 0.75	4	1.5	100														
				16.5																			
				18.0																			

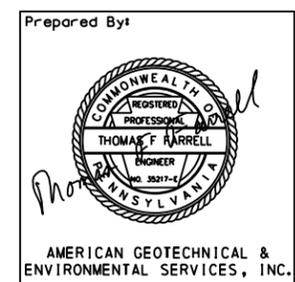
¹24-hr. Water: Boring grouted upon completion.

M:_2018\056\enhtb1\structure\18056_srb.dgn 5/15/2018

COMMONWEALTH OF PENNSYLVANIA
 DEPARTMENT OF TRANSPORTATION
 ERIE COUNTY
 ERIE INTERNATIONAL AIRPORT
 SNOW REMOVAL EQUIPMENT BUILDING

TEST BORINGS (SHEET 1 OF 4)

SHEET ___ OF ___



GENERAL NOTES

THIS SHEET IS INCLUDED FOR THE CONVENIENCE OF THE DEPARTMENT. REFER TO PUBLICATION 408 SECTION 102.05 FOR FURTHER INFORMATION.

FOR ADDITIONAL SOIL AND ROCK DESCRIPTIONS SEE PUBLICATION 222.

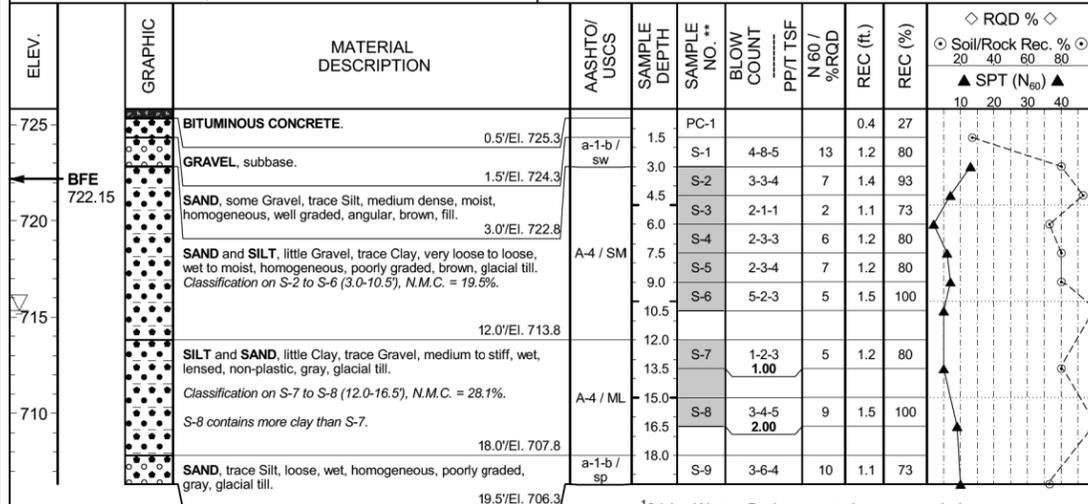
THE BORING LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED. SUBSURFACE CONDITIONS MAY DIFFER FROM THE CONDITIONS REPORTED AT THE SPECIFIC LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE OF CONDITIONS AT THE BORING LOCATIONS.

LEGEND

- PP POCKET PENETROMETER
- TOR TOP OF ROCK ELEVATION
- BFE BOTTOM OF FOOTING ELEVATION

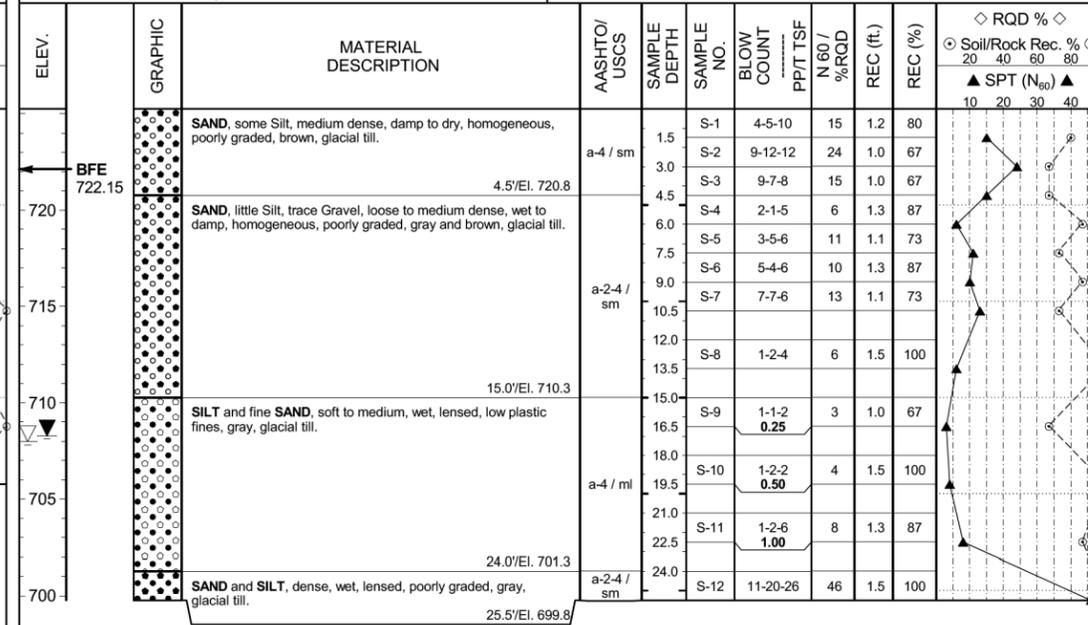
THE DESCRIPTION OF THE MATERIALS ENCOUNTERED HAVE BEEN VERIFIED.
OFF

SUBSTRUCTURE UNIT: SNOW REMOVAL EQUIPMENT BUILDING				LOG 1 OF 1
BORING NUMBER: SRE-3	BORING LOCATION STATION: OFFSET:	START: 05/08/2018 1:00 PM FINISH: 05/08/2018 2:30 PM	HAMMER: SAFETY EFFICIENCY: 0.6 ERa	
DRILLING METHOD AND EQUIPMENT: -, SAFETY, SIMCO 2800 TRAILER		SIZE OF CORE: "NO RECORD"	VERTICAL SCALE: 0 FT. 5 FT.	TOP OF BORING ELEVATION: 725.3 FT.
DRILLING INSPECTOR: ZACHERY ROBERTSON DRILLER & DRILLING COMPANY: A. SUNDBERG R. RINDFUSS DRILLING, L.P.		▽ 0 HR. READING - ELAPSED TIME: EI. 715.3 ft. - 0.0 hr. ▼ 24 HR. READING - ELAPSED TIME: NR - NR ¹		



¹24-hr. Water: Boring grouted upon completion.
**SAMPLE NO. shading indicates lab testing performed.

SUBSTRUCTURE UNIT: SNOW REMOVAL EQUIPMENT BUILDING				LOG 1 OF 1
BORING NUMBER: SRE-4	BORING LOCATION STATION: OFFSET:	START: 05/07/2018 12:30 PM FINISH: 05/07/2018 2:00 PM	HAMMER: SAFETY EFFICIENCY: 0.6 ERa	
DRILLING METHOD AND EQUIPMENT: -, SAFETY, SIMCO 2800 TRAILER		SIZE OF CORE: "NO RECORD"	VERTICAL SCALE: 0 FT. 5 FT.	TOP OF BORING ELEVATION: 725.3 FT.
DRILLING INSPECTOR: ZACHERY ROBERTSON DRILLER & DRILLING COMPANY: A. SUNDBERG R. RINDFUSS DRILLING, L.P.		▽ 0 HR. READING - ELAPSED TIME: EI. 708.0 ft. - 0.0 hr. ▼ 24 HR. READING - ELAPSED TIME: EI. 708.3 ft. - 26.0 hr.		



M:_2018\05\056\enr\18056_srb.dgn 5/15/2018

Prepared By

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
ERIE COUNTY
ERIE INTERNATIONAL AIRPORT
SNOW REMOVAL EQUIPMENT BUILDING

TEST BORINGS (SHEET 2 OF 4)

SHEET ___ OF ___

GENERAL NOTES

THIS SHEET IS INCLUDED FOR THE CONVENIENCE OF THE DEPARTMENT. REFER TO PUBLICATION 408 SECTION 102.05 FOR FURTHER INFORMATION.

FOR ADDITIONAL SOIL AND ROCK DESCRIPTIONS SEE PUBLICATION 222.

THE BORING LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED. SUBSURFACE CONDITIONS MAY DIFFER FROM THE CONDITIONS REPORTED AT THE SPECIFIC LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE OF CONDITIONS AT THE BORING LOCATIONS.

LEGEND

- PP POCKET PENETROMETER
- TOR TOP OF ROCK ELEVATION
- BFE BOTTOM OF FOOTING ELEVATION

THE DESCRIPTION OF THE MATERIALS ENCOUNTERED HAVE BEEN VERIFIED.

OFF

Prepared By

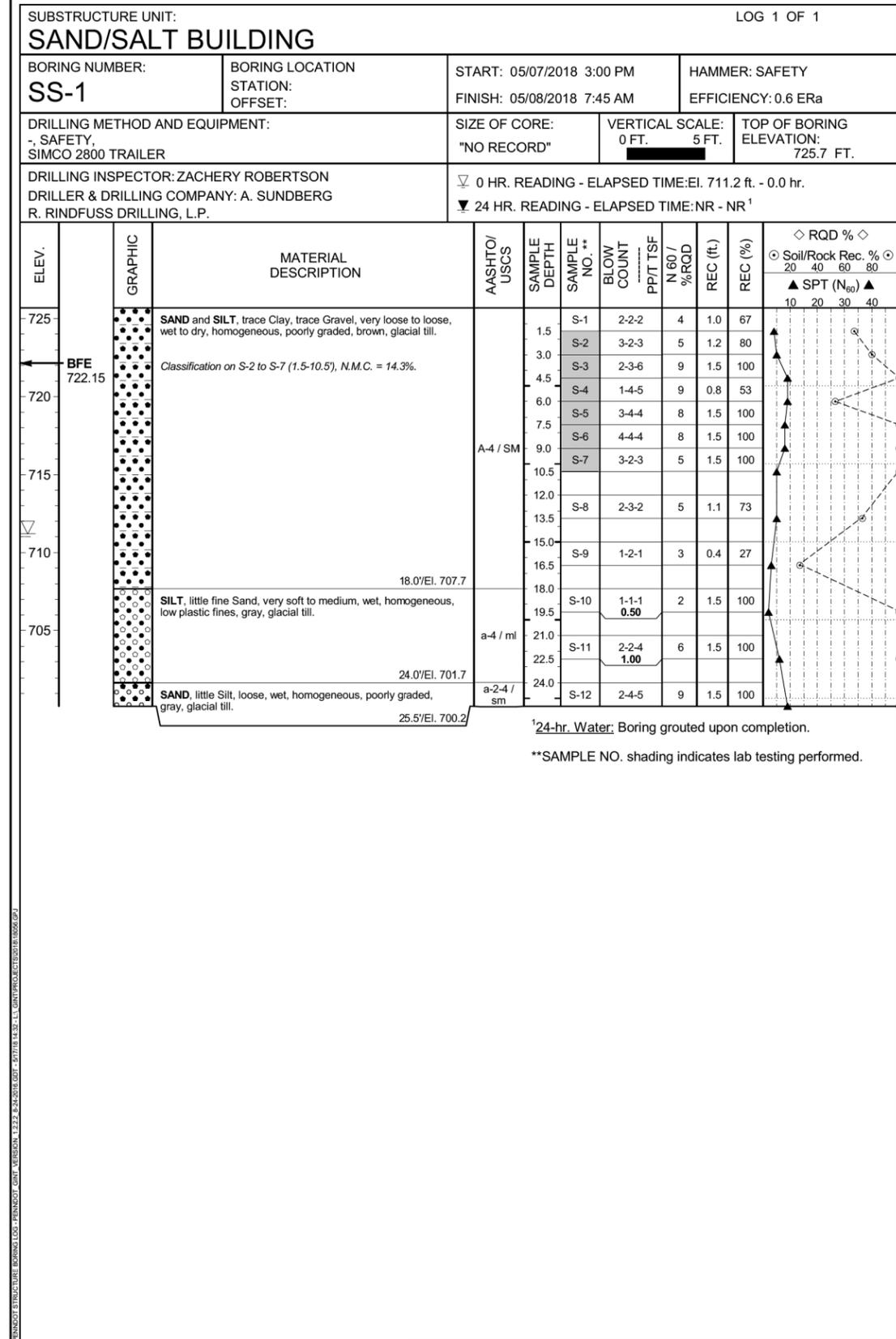
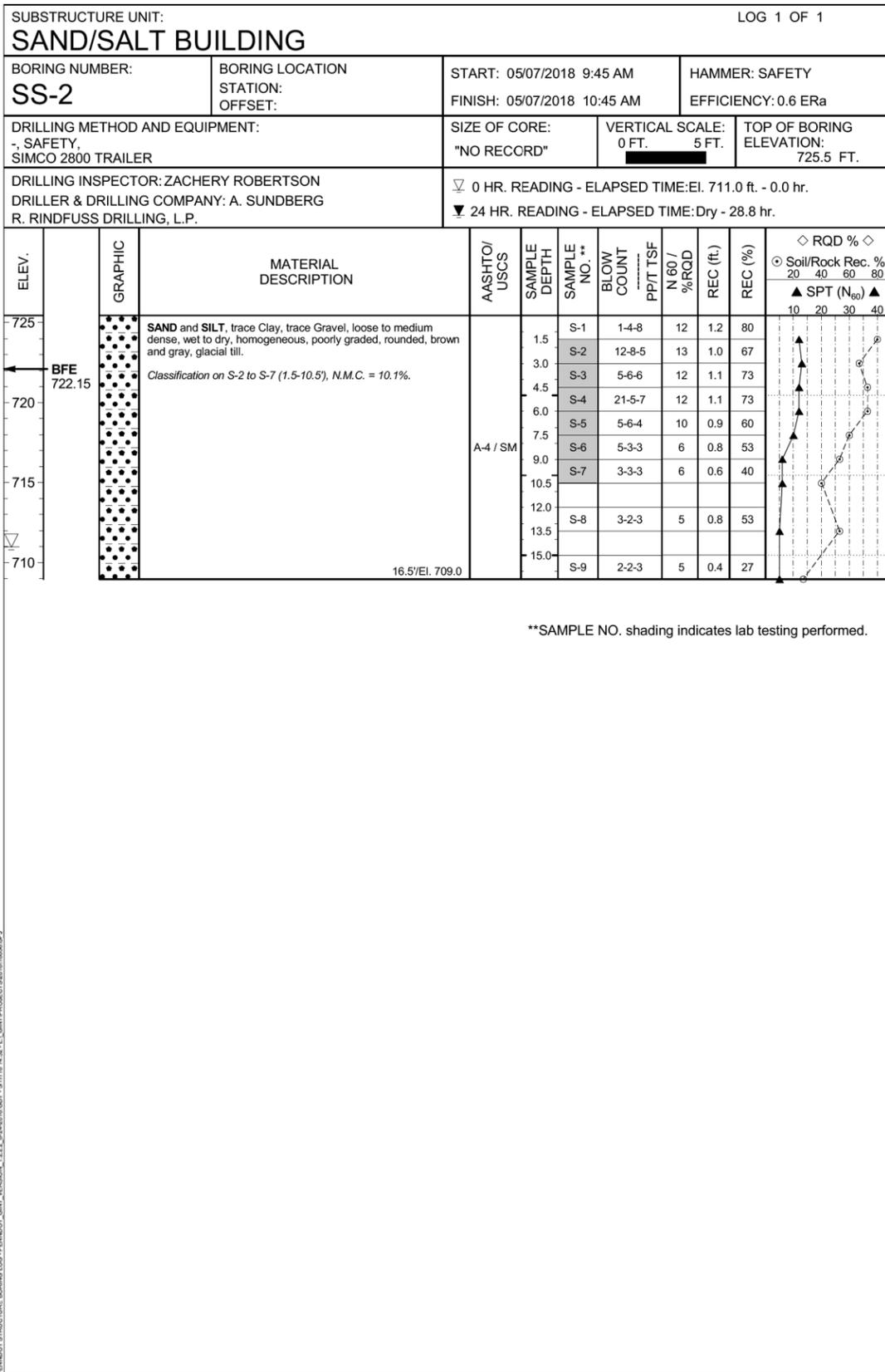


AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
ERIE COUNTY
ERIE INTERNATIONAL AIRPORT
SNOW REMOVAL EQUIPMENT BUILDING

TEST BORINGS (SHEET 3 OF 4)

SHEET ___ OF ___



M:_2018\056\enr\18056_s1rb.dgn 5/15/2018

ATTACHMENT 5

CONSTRUCTION SAFETY PHASING

PLAN (CSPP)



CONSTRUCTION SAFETY AND PHASING PLAN

ERIE REGIONAL AIRPORT AUTHORITY

ERIE INTERNATIONAL AIRPORT

SRE BUILDING DESIGN

February 2019

Prepared by:

Michael Baker

I N T E R N A T I O N A L

Michael Baker International, Inc.

100 Airside Drive

Airside Business Park

Moon Township, PA 15108

412.269.6300

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(a) Contractor Progress Meetings	2
(b) Scope or Schedule Changes	2
(c) FAA ATO Coordination	2
206. Phasing	2
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APPENDIX 1: Project Layout Plan

General

This Construction Safety and Phasing Plan (CSPP) was prepared to meet the requirements of FAA Advisory Circular 150/5370-2G, *Operational Safety on Airports During Construction* for the Erie Regional Airport Authority's (ERAA), Snow Removal Equipment Building (SRE Building), at Erie International Airport (ERI). This work is anticipated to be constructed in 2019. The limit of work is shown on the attached Project Layout Plan (Appendix 1).

The purpose of the proposed project, "SRE Building Design," is to design and construct a new SRE Storage Building to be located in the northern portion of the airfield adjacent to the existing Maintenance Building, Sand Storage Building, and above ground storage tanks. The purpose of the proposed building will strictly be to store snow removal vehicles and equipment. This will keep the vehicles and equipment out of the weather and prolong their useful life. The SRE Storage Building will be designated as a single "garage" space and classified as a S-2 Storage Use Group.

The building shall be prefinished formed metal roof panels, prefinished insulated metal wall panels with translucent wall providing daylight, and insulated overhead coiling metal doors.

All work is expected to occur outside of the Runway Safety Area (RSA) and Taxiway Safety Area (TSA) but within the Transitional Surface of Runway 2-20. The proposed SRE Building is a significant distance away from Runway 2-20 (at least 460 ft from the centerline) so Taxiway B TSA is depicted on the attached Figure 2 Site Plan.

Project specific safety and phasing notes are included in the drawings and specifications for this project. The information below provides a detailed summary of the safety and phasing aspects of the project in accordance with FAA AC 150/5370-2F, *Operational Safety on Airports During Construction*.

205. Coordination

As the party responsible for airport safety, the ERAA has established, and will enforce, this CSPP. The Contractor that is awarded the contract will be required to comply with the provisions of this CSPP, as a condition of the contract, by executing a Safety Plan Compliance Document (SPCD). The Contractor shall incorporate into the SPCD details of how it will comply with the CSPP along with any supplemental information that could not be included in this CSPP prior to the award of the contract. The supplemental information in the SPCD must be written to match the format of this CSPP indicating each subject by corresponding CSPP subject number and title. If no supplemental information is necessary for any specific subject, the statement, "No supplemental information," should be written after the corresponding subject title. The SPCD should not duplicate the information in the CSPP.

Coordination of the project will begin with a pre-construction meeting that will be scheduled as soon as practical after the award of the contract, but prior to the Notice-To-Proceed being issued to the Contractor. The following individuals will be invited to these meetings:

- Project Design Engineer
- Project Resident Engineer

- Airport Management (Airport Operations, Airport Rescue Fire Fighting (ARFF), Police, Maintenance, Engineering)
- Contractor, including appropriate Subcontractor(s)
- Contractor's Project Superintendent
- Contractor's Project Clerk
- Federal, State, or Local Agencies Affected by the Proposed Construction
- Representative of FAA Airports Regional or Field Office
- Representative of ERI FAA Traffic Manager

These meetings will be conducted within the guidelines of AC 150/5370-12B, "Quality Management for Federally Funded Airport Construction Projects."

(a) Contractor Progress Meetings

Once the construction begins the Contractor will be required to hold weekly Progress Meetings to discuss the work accomplished and the work that is anticipated. Airfield safety will be a standing agenda item at each of these meetings.

(b) Scope or Schedule Changes

All changes in the Scope of Work or the schedule will be submitted to ERAA for review and approval, and coordinated with the affected parties prior to being incorporated into the project CSPP revisions.

(c) FAA ATO Coordination

It is not anticipated that any airway facilities will be impacted as part of the proposed project. No closures are set to take place during the duration of this project. If impacts occur, they shall be coordinated with FAA ATO.

206. Phasing

This project will be accomplished in one (1) major phase of work. All runways and taxiways will remain operational for the duration of this project. The contractor is required to submit a detailed construction schedule to the Sponsor prior to the beginning of construction so the Erie Regional Airport Authority (ERAA / Sponsor) can issue appropriate NOTAMs, if necessary.

207. Areas and Operations Affected by Construction Activity

(a) Identification of Affected Areas

Temporary construction equipment and permanent buildings erected will not impact any portion of Runway 2-20 primary and/or transitional surfaces.

Areas affected by construction activities are as follows:

- Northern portion of the airfield adjacent to the existing Maintenance Building, Sand Storage Building and above ground storage tanks

(b) Mitigation of Effects

Temporary fencing will be erected around the construction perimeter of the work area to remove the site from the AOA for the duration of the project.

208. Navigational Aid (NAVAID) Protection

There will not be any NAVAIDs removed or shut down as part of this project.

209. Contractor Access

The Contractor shall access the work areas via ARFF Road for the duration of this project. The temporary fence that connects to the permanent perimeter fence will act as a boundary of work for all contractors. No access to the Air Operations Area (AOA) is anticipated.

(a) Location of Stockpiled Construction Materials

All stockpiled construction materials shall be in one of the Contractor's Staging Areas shown on the attached Project Layout Plan. All materials shall be stored in a manner to prevent Foreign Object Debris (FOD) within and around the Airport as indicated in Section 211. All materials shall also be stored in a manner as to not attract wildlife within and around the Airport, as indicated in Section 210.

(b) Vehicle and Pedestrian Operations

Contractor's personnel vehicles that are not required on the project site shall be parked in the Contractor's Staging Areas shown on the attached Project Layout Plan, or in areas designated by ERAA prior to the start of construction.

210. Wildlife Management

Wildlife can be a very serious hazard within the AOA. Therefore, precautions must be taken to mitigate the following elements that attract wildlife or otherwise increase the risk caused by the presence of wildlife. The Contractor is required to control and remove all loose materials and waste to ensure there is no trash, standing water or seeding left behind that may attract wildlife. One gate will be used to access the project, which the Contractor is required to maintain. There are no wildlife habitats in the project area that the Contractor could potentially disrupt. The Contractor is also required to store materials and equipment in such a fashion to prevent attracting wildlife.

(a) Trash

All trash, including food scraps, generated by the Contractor from the construction activities or the activities of the Contractor's personnel shall be collected and placed in a container that prevents animals from rummaging through it. This container shall be emptied before it becomes full.

(b) Standing Water

During the construction the Contractor shall ensure that there is no standing water within the work site and within the staging areas.

(c) Tall Grass and Seeds

Any area that has become disturbed by the Contractor shall become the responsibility of the Contractor until vegetation has been established and accepted. Only the seed indicated in the project documents

shall be allowed for use in and around the Airport. The maintenance of the turf areas shall be coordinated with the Engineer and Airport at the progress meetings.

(d) Poorly Maintained Fencing and Gates

A temporary fence will need to seamlessly adhere to the permanent perimeter fence to deny access to the AOA. This continuous fence will need to be maintained throughout the duration of this project.

(e) Disruption of Existing Wildlife Habitat

It is not anticipated that existing wildlife habitat will be disrupted during the construction of this project.

211. Foreign Object Debris (FOD) Management

Foreign Object Debris (FOD) is a serious hazard on the AOA. It can cause serious damage to aircraft, equipment, or personnel. FOD can also lead to serious accidents resulting in injury or death. Sources of FOD include but are not limited to material containers, tools, and food/beverage containers.

The Contractor shall instruct all personnel in recognizing FOD and the hazards it presents, and provide receptacles for FOD collection throughout the project's duration. The Contractor shall conduct all operations in a manner to prevent FOD. These items shall be cleaned up as they are produced, and placed in a secure location or receptacle where they will not be subject to wind or other means of dispersal within the AOA. Before leaving the site at the end of each work period the Contractor is required to inspect the area and clear it of any FOD.

212. Hazardous Materials (HAZMAT) Management

Management of hazardous material is required in order to prevent environmental damage as well as protect property and personnel.

Hazardous materials common to construction sites include vehicle fuels, oils, lubricants, and hydraulic fluid as well as many materials/compounds used for the actual construction of the work.

The Contractor shall store all such materials in containers approved for such use, shall have the Material Safety Data Sheets (MSDS) on site for all such materials, and shall have cleanup materials recommended by the MSDS on site and readily available for use in the event of a spill. All materials shall be used in strict accordance to the manufacturer's instructions and should be prepared to meet inspection at any time.

Transfer of materials from one container to another shall be done in areas where a spill is least likely to cause damage such as away from streams, storm sewer inlets, etc. Fueling of vehicles and equipment shall be done at designated areas within the staging areas shown on the attached Project Layout Plan. No fueling shall occur in areas inside the AOA, such as runways, taxiways, or aprons outside of the staging areas.

Appropriate spill kits shall be available for all refueling operations. All contaminated materials from used spill kits shall be removed from the site and properly disposed of immediately after use.

Any spill, regardless of size, must be reported to the Airport Operations at (814) 450-8264 and Erie County Hazmat Team at (814) 451-7920.

The following instructions are taken from AC 150/5320-15A, *“Management of Airport Industrial Waste”* and the Airport’s Spill Prevention and Control Countermeasure (SPCC) plan shall be followed in the event of a hazardous spill:

(a) Cleanup-General

Clean up leaks and spills immediately. Use a rag, absorbent pad, or other suitable material for small spills on paved surfaces, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste in designated areas.

Never hose down or bury dry material spills. Clean up as much of the material as possible and properly dispose of legally off airport property. Refer to the ERAA spill plan or contact Airport Police for additional instructions.

(b) Minor Spills

Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.

- Contain the spread of the spill.
- Notify the project foreman immediately
- Use absorbent materials on small spills – DO NOT hose down or bury the spill. Recover spilled materials.
- Absorbent materials should be promptly removed and properly disposed of legally off airport property.
- Clean the contaminated area and properly dispose of contaminated materials legally off airport property

(c) Semi-Significant Spills

Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities. The Contractor shall immediately notify Airport Operations at (814) 450-8264.

- Contain the spill.
- Notify the project foreman immediately.
- If the spill occurs on paved or impermeable surfaces, clean it up using “dry” methods (absorbent materials and do not let the spill spread widely)
- If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soils.
- If the spill occurs during rain, cover the spill with tarps or other material to prevent contaminating runoff.

(d) Significant/ Hazardous Spills

For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps should be taken:

- The Contractor shall immediately notify Airport Operations at (814)450-8264.
- The Airport will notify the proper county officials as per the spill plan.
- The construction personnel should not attempt to clean up the spill until the appropriate and qualified staffs have arrived at the spill site.
- The Contractor shall complete the airport's spill form written report.

The services of a spill contractor or a HAZMAT team should be obtained immediately, and such response will be coordinated between the Airport and the Contractor.

(e) Reporting

The Contractor must report significant spills to the Airport and shall comply with all Airport reporting requirements.

Federal regulations require that any significant oil spill into a water body or onto adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours). The Airport will make any required notifications.

213. Notification of Construction Activities

The Contractor shall coordinate all construction activities with the Engineer at the progress meetings.

(a) List of Responsible Representatives

A contact list will be developed prior to the start of the project, and must be updated as needed by both the Airport and the Contractor. This list will be provided to Airport Operations, Airport Engineering, ARFF, the Project Resident Engineer/Inspector, and the Project Design Engineer.

The contact list will include at a minimum both emergency and routine phone numbers for at least three on-site contractor personnel who will be available 24 hours a day, and the following airport staff:

- ERAA Executive Director
- ERAA Director of Maintenance and Operations
- ARFF
- Airport Police
- Engineer

(b) NOTAMs

There are no NOTAMs anticipated to be issued as a part of this project.

(c) Emergency Notification Procedures

For fire or police emergencies and emergency medical response, contact 911. For minor issues contact Airport Police at (814) 397-9911.

(d) Coordination with ARFF

Airport Operations will coordinate with ARFF personnel all impact of construction phasing to ARFF operations. The Contractor shall advise Airport Operations of changes to its work or the character of the work to be done well in advance so that any impact to ARFF operations is mitigated.

(e) Notification to the FAA

The FAA will be notified of the construction activities and the impact to the airfield via FAA Form 7460-1, "Notice of Proposed Construction or Alternation", which will be submitted to the FAA Airports Regional or District Office.

214. Inspection Requirements

This project is subject to inspections by the FAA, Airport, Engineer, PennDOT Bureau of Aviation, Pennsylvania Department of Environmental Protection (PaDEP), and Erie County Conservation District (ECCD) at any time during the construction. In addition, the Contractor shall designate an employee as a safety officer whose duty shall be to periodically inspect the work area with respect to safety issues.

(a) Daily Inspections

Airport representatives will meet the contractor on a regular schedule to ensure required safety measures are in place and to ensure the temporary fence remains secure.

(b) Final Inspections

The Airport will coordinate with the FAA to determine if a final inspection of the work area will be necessary.

215. Underground Utilities

The known utilities that traverse the site are shown on the contract documents. The Contractor shall contact the PA One Call System at 1-800-242-1776 at least three days prior to the beginning of any work, and coordinate with the Engineer to locate any other utilities that traverse the site, including Airport and FAA owned utilities prior to beginning any work on the site. In the event that a utility is damaged, the Contractor shall immediately notify the Engineer, and immediately begin to repair the utility. This repair shall be performed continuously until complete. One-call services do not mark FAA utilities.

216. Penalties

Security related violations will result in the temporary suspension or revocation of an employee's Security ID Badge. Other safety related violations of airport rules and regulations may result in temporary or permanent suspension of work or removal of the individual from the project. Certain violations could also result in fines being levied by the FAA and/ or the Transportation Safety Administration.

217. Special Conditions

Contractor access may be restricted during times of poor weather conditions, during emergencies, security breaches, or safety violations. Notification will be made by Airport Operations to the Engineer and the Contractor. Work may not resume until notification from Airport Operations is received.

218. Runway and Taxiway Visual Aids

Runway and taxiway visual aids will not be affected during this project.

219. Marking and Signs for Access Routes

The project access route consists of existing roads.

The Contractor will need to coordinate locations of construction entrances and vehicle directional signage from the designated entry points along the haul route to the project area as required by the Airport. These signs shall comply with the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or PennDOT highway specifications.

220. Hazard Marking, Lighting, and Signing

(a) Personnel Safety

Personnel on the construction site must wear reflective vest or safety green outer garments (t-shirts, coats, etc). Personnel are strongly encouraged to wear ear protection when operating near aircraft noise.

221. Protection of Runway and Taxiway Safety Areas

(a) Runway Safety Area (RSA)

There will be no impact to the Runway Safety Area (RSA) during this project.

(b) Runway Object Free Area (ROFA)

There will be no impact to the Runway Object Free Area (ROFA) during this project.

(c) Taxiway Safety Area (TSA)

There will be no impact to the Taxiway Safety Area (TSA) during this project.

(d) Taxiway Object Free Area (TOFA)

There will be no impact to the Taxiway Object Free Area (TOFA) during this project.

(e) Runway Obstacle Free Zone (OFZ)

There will be no impact to the Runway Obstacle Free Zone (OFZ) during this project.

(f) Runway Approach/Departure Areas and Clearways

There will be no impact to the Runway Approach/Departure Areas and Clearways during this project.

222. Other Limitations on Construction

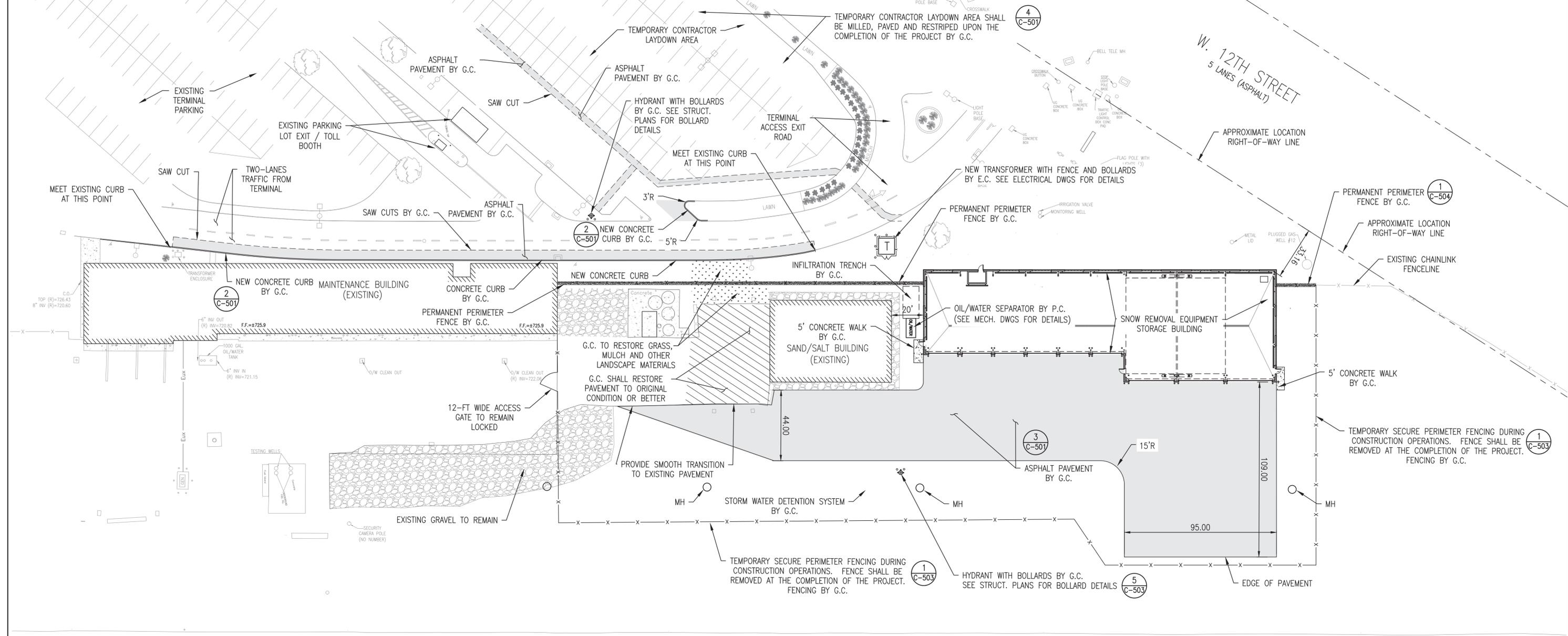
(a) Prohibitions

- Smoking is not permitted anywhere on the AOA at any time.
- Hot work permits must be obtained from ARFF for any work involving an open flame.
- The Contractor shall not use equipment that is over 30 feet in height.
- Flare pots will not be permitted.

(b) Restrictions

- Work will be temporarily restricted when conditions described in section 217 occur.

APPENDIX 1
PROJECT LAYOUT PLAN



TAXIWAY "B"

LEGEND	
	FIRE HYDRANT
	LIGHT POLE
	INLET
	TREES
	PROPOSED ASPHALT
	PROPERTY / ROW LINE
	FENCE LINE
	EXISTING SANITARY SEWER
	PROPOSED SANITARY SEWER
	EXISTING STORM SEWER
	PROPOSED STORM SEWER
	EXISTING UNDERGROUND ELECTRIC
	PROPOSED UNDERGROUND ELECTRIC
	PROPOSED WATER LINE
	PROPOSED UNDERDRAIN
	EXISTING CONTOUR
	PROPOSED CONTOUR



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BAKER & ASSOCIATES
 CONSULTING ENGINEERS AIRSIDE BUSINESS PARK
 (412) 269-6300 100 AIRSIDE DRIVE
 MOON TOWNSHIP, PA 15108

DESIGNED	_____	DATE	_____
DRAWN	_____	DATE	_____
CHECKED	_____	DATE	_____
APPROVED	_____	DATE	_____

REVISION		
DATE	BY	DESCRIPTION



ERIE INTERNATIONAL AIRPORT
 ERIE, PENNSYLVANIA

SNOW REMOVAL EQUIPMENT BUILDING		SHEET	8
SITE PLAN		C-103	OF 61
PROJECT NO: 163078		DATE: FEBRUARY 06, 2019	

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ERIE INTERNATIONAL AIRPORT, TOM RIDGE FIELD SNOW REMOVAL EQUIPMENT BUILDING

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SECTION 011200 - MULTIPLE CONTRACT SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other General Provisions Sections apply to this Section.

1.2 SUMMARY

- A. Section includes a summary of each contract, including responsibilities for coordination and temporary facilities and controls.
- B. Specific requirements for Work of each contract are also indicated in individual Specification Sections and on Drawings.

1.3 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, the condition at which roofing is insulated and weathertight; exterior walls are insulated and weathertight; and openings are closed with permanent construction or substantial temporary closures equivalent in weather protection to permanent construction.

1.4 PROJECT COORDINATOR

- A. Project coordinator (General/Site Contractor) shall be responsible for coordination between the General / Site Construction Contract (C-1), Plumbing Contract (C-2), Mechanical (HVAC) Contract (C-3), Electrical Contract (C-4).

1.5 PROJECT COORDINATOR RESPONSIBILITIES

- A. Project coordinator shall perform Project coordination activities for the multiple contracts, including, but not limited to, the following:
 - 1. Provide typical overall coordination of the Work.
 - 2. Coordinate shared access to workspaces.
 - 3. Coordinate product selections for compatibility.
 - 4. Provide overall coordination of temporary facilities and controls.
 - 5. Coordinate, schedule, and approve interruptions of permanent and temporary utilities, including those necessary to make connections for temporary services.
 - 6. Coordinate construction and operations of the Work with work performed by each Contract.
 - 7. Prepare coordination drawings in collaboration with each contractor to coordinate work by more than one contract.

8. Coordinate sequencing and scheduling of the Work. Include the following:
 - a. Initial Coordination Meeting: At earliest possible date, arrange and conduct a meeting with contractors for sequencing and coordinating the Work; negotiate reasonable adjustments to schedules.
 - b. Prepare combined Contractors' Construction Schedule for entire Project. Base schedule on preliminary construction schedule. Secure time commitments for performing critical construction activities from contractors. Show activities of each contract on a separate sheet. Prepare a simplified summary sheet indicating combined construction activities of contracts.
 - 1) Submit schedules for approval.
 - 2) Distribute copies of approved schedules to contractors.
 9. Provide photographic documentation.
 10. Provide quality-assurance and quality-control services specified in Section 100 "Contractor Quality Control Program"
 11. Coordinate sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections.
 12. Provide information necessary to adjust, move, or relocate existing utility structures affected by construction.
 13. Locate existing permanent benchmarks, control points, and similar reference points, and establish permanent benchmarks on Project site.
 14. Provide field surveys of in-progress construction and site work.
 15. Provide progress cleaning of common areas and coordinate progress cleaning of areas or pieces of equipment where more than one contractor has worked.
 16. Coordinate cutting and patching.
 17. Coordinate protection of the Work.
 18. Coordinate completion of interrelated punch list items.
 19. Coordinate preparation of Project Record Documents if information from more than one contractor is to be integrated with information from other contractors to form one combined record.
 20. Print and submit Record Documents if installations by more than one contractor are indicated on the same Contract Drawing or Shop Drawing.
 21. Collect record Specification Sections from contractors, collate Sections into numeric order, and submit complete set.
 22. Coordinate preparation of operation and maintenance manuals if information from more than one contractor is to be integrated with information from other contractors to form one combined record.
- B. Responsibilities of Project coordinator for temporary facilities and controls include, but are not limited to, the following:
1. Provide common-use field office for use by all personnel engaged in construction activities.
 2. Provide Engineer's field office for the duration of the project.
 3. Provide telephone service for common-use facilities.

1.6 GENERAL REQUIREMENTS OF CONTRACTS

- A. Extent of Contract: Unless the Agreement contains a more specific description of the Work of each Contract, requirements indicated on Drawings and in Specification Sections determine which contract includes a specific element of Project.
 - 1. Unless otherwise indicated, the work described in this Section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents.
 - 2. Trenches and other excavation for the work of each contract shall be the work of the General Construction Contract.
 - 3. Blocking, backing panels, sleeves, and metal fabrication supports for the work of each contract shall be the work of each contract for its own work.
 - 4. Furnishing of access panels for the work of each contract shall be the work of each contract for its own work. Installation of access panels shall be the work of contract for its own work.
 - 5. Equipment pads for the work of each contract shall be the work each contract for its own work.
 - 6. Roof-mounted equipment curbs for the work of each contract shall be the work of each contract for its own work.
 - 7. Painting for the work of each contract shall be the work of the General Construction Contract.
 - 8. Cutting and Patching: Each contract shall perform its own cutting; patching shall be under the General Construction Contract.
 - 9. Contractors' Startup Construction Schedule: Within five working days after startup horizontal bar-chart-type construction schedule submittal has been received from Project coordinator, submit a matching startup horizontal bar-chart schedule showing construction operations sequenced and coordinated with overall construction.

- B. Substitutions: Each contractor shall cooperate with other contractors involved to coordinate approved substitutions with remainder of the work.
 - 1. The General Construction Contract shall coordinate substitutions.

- C. Temporary Facilities and Controls: Each contractor is responsible for the following:
 - 1. Installation, operation, maintenance, and removal of each temporary facility necessary for its own normal construction activity, and costs and use charges associated with each facility, except as otherwise provided for in this Section.
 - 2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
 - 3. Its own field office, complete with necessary furniture, utilities, and telephone service.
 - 4. Its own storage and fabrication sheds.
 - 5. Temporary enclosures for its own construction activities.
 - 6. Staging and scaffolding for its own construction activities.
 - 7. General hoisting facilities for its own construction activities, up to 2 tons (2000 kg).
 - 8. Waste disposal facilities, including collection and legal disposal of its own hazardous, dangerous, unsanitary, or other harmful waste materials.
 - 9. Progress cleaning of work areas affected by its operations on a daily basis.
 - 10. Secure lockup of its own tools, materials, and equipment.

11. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
- D. Temporary Heating, Cooling, and Ventilation: The General Construction Contract is responsible for temporary heating, cooling, and ventilation before weathertight enclosure of building is complete. The Mechanical (HVAC) Contract is responsible for temporary heating, cooling, and ventilation after permanent enclosure of building is complete and Owner will pay utility-use charges.
- E. Use Charges: Comply with the following:
 1. Sewer Service: Include the cost for sewer service use by all parties engaged in construction activities at Project site in the General Construction Contract.
 2. Water Service: Include the cost for water service, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site in the General Construction Contract.
 3. Electric Power Service: Include the cost for electric power service, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site in the General Construction Contract.

1.7 GENERAL CONSTRUCTION CONTRACT (C-1)

- A. Work of the General Construction Contract includes, but is not limited to, the following:
 1. Remaining work not identified as work under other contracts.
 2. Site preparation, including clearing, building demolition and relocations, and earthwork.
 3. Site improvements, including roadways, parking lots, pedestrian paving, site development furnishings and equipment, and landscaping.
 4. Tunnels for site utilities.
 5. Selective demolition.
 6. Foundations, including footings, foundation walls, and piers.
 7. Slabs-on-grade, including earthwork, subdrainage systems, and insulation.
 8. Below-grade building construction, including excavation, backfill, and insulation and waterproofing/dampproofing.
 9. Superstructure, including floor and roof construction
 10. Exterior closure, including walls, doors, windows, and louvers.
 11. Roofing, including roof insulation, coverings, flashings roof specialties, roof accessories and glazed openings.
 12. Interior construction, including partitions.
 13. Fire-protection specialties.
 14. Fire alarm systems.
 15. Interior finishes and floor and ceiling finishes.
 16. Conveying systems, including cranes.
 17. Equipment, including the following:
 - a. Guardrails
 - b. Bollards.
 18. Special construction, including the following:
 - a. Pre-engineered structures.

- B. Temporary facilities and controls in the General Construction Contract include, but are not limited to, the following:
1. Temporary facilities and controls that are not otherwise specifically assigned to the Plumbing Contract, HVAC Contract or Electrical Contract.
 2. Sediment and erosion control.
 3. Unpiped sewers and drainage, including drainage ditches, dry wells, stabilization ponds, and containers.
 4. Stormwater control.
 5. Unpiped temporary toilet fixtures, wash facilities, and drinking water facilities, including disposable supplies.
 6. Temporary enclosure for building exterior, except as indicated.
 7. Temporary roads and paved areas.
 8. Dewatering facilities and drains.
 9. Excavation support and protection, unless required solely for the Work of another contract.
 10. Special or unusual hoisting requirements for construction activities, including hoisting loads in excess of 2 tons (2000 kg), hoisting material or equipment into spaces below grade, and hoisting requirements outside building enclosure.
 11. Project identification and temporary signs.
 12. General waste disposal facilities.
 13. Pest control.
 14. Temporary fire-protection facilities.
 15. Barricades, warning signs, and lights.
 16. Site enclosure fence.
 17. Covered walkways.
 18. Security enclosure and lockup.
 19. Environmental protection.
 20. Engineer's field office. The contractor shall furnish for the duration of the project one building for the use of the field Engineers and inspectors, as a field office. This facility shall be an approved weatherproof building meeting the current State Highway Specifications (for example, Class I Field Office or Type C Structure). This building shall be located conveniently near to the construction and shall be separate from any building used by the Contractor. The Contractor shall furnish photocopy machine, water, sanitary facilities, heat, air conditioning, and electricity. The Contractor and the Contractor's superintendent shall provide all reasonable facilities to enable the Engineer to inspect the workmanship and materials used into the work.

1.8 PLUMBING CONTRACT (C-2)

- A. Work of the Plumbing Contract includes, but is not limited to, the following:

1. Provisions for Site Plumbing Systems
 - a. Water supply
 - b. Natural gas supply
 - c. Sanitary sewerage
 - 1) Oil / water separator
 - d. Storm drainage
2. Provisions for Building Plumbing Systems
 - a. Plumbing fixtures

- 1) Floor drains
- 2) Trench drains
- 3) Hose bibbs
- 4) Wall hydrants (non-freeze)
- 5) Emergency eye-wash station (portable)
- b. Domestic water distribution
- c. Sanitary, waste and vent piping
- d. Natural gas distribution
3. Provisions for Fire-Suppression systems
4. Provisions for Plumbing connections to equipment furnished by the HVAC Contract.

1.9 MECHANICAL (HVAC) CONTRACT (C-3)

- A. Work of the HVAC Contract includes, but is not limited to, the following:
1. Provisions for HVAC systems and equipment
 - a. Infrared radiant heaters
 - b. Ventilation fans and louvers
 - c. Unit heaters
 2. Provisions for HVAC instrumentation and controls.
 3. Provisions for HVAC testing, adjusting, and balancing.

1.10 ELECTRICAL CONTRACT (C-4)

- A. Work of the Electrical Contract includes, but is not limited to, the following:
1. Site electrical distribution.
 2. Site lighting.
 3. Site communications and security.
 4. Electrical service and distribution.
 5. Exterior and interior lighting.
 6. Communication and security.
 7. Fire alarm systems
 8. Special electrical systems, including the following:
 - a. Cathodic protection.
 - b. Electromagnetic shielding systems.
 - c. Lightning protection systems.
 - d. Unit power conditioners.
 - e. Power generation systems.
 9. Electrical connections to equipment furnished by the Electrical Contract.
- B. Temporary facilities and controls in the Electrical Contract include, but are not limited to, the following:
1. Electric power service and distribution.
 2. Lighting, including perimeter lighting.
 3. Electrical connections to existing systems and temporary facilities and controls furnished by the Electrical Contract.

ERIE INTERNATIONAL AIRPORT, TOM RIDGE FIELD SNOW REMOVAL EQUIPMENT BUILDING

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011200

SECTION 033000 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Section 321313 "Curbs and Sidewalks" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 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.
 - e. Special concrete finish Subcontractor.
 - 2. Review cold- and hot-weather concreting procedures, curing procedures, anchor rod and anchorage device installation tolerances, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- 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. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

- A. Material Certificates: 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. Curing compounds.
 - 6. Floor and slab treatments.
 - 7. Adhesives.
 - 8. Semi rigid joint filler.
 - 9. Joint-filler strips.
 - 10. Repair materials.
- B. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- C. 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 reshoring installation and removal.
- D. Field quality-control reports.
- E. Minutes of preinstallation conference.

1.7 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.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 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. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.10 FIELD CONDITIONS

- A. 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.

- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, 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.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 117.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that 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.
 - 3. Overlaid Finnish birch plywood.
- 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 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. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

- F. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, 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.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. 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. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I/II.
 - 2. Fly Ash: ASTM C 618, Class F.
 - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

- C. Normal-Weight Aggregates: ASTM C 33/C 33M, 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. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do 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.
- F. 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.
- G. Water: ASTM C 94/C 94M and potable.

2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

2.7 FLOOR AND SLAB TREATMENTS

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- 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 and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semi rigid Joint Filler: Two-component, semi rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.10 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/C 150M, 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 4500 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 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, 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.

2.11 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: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
 2. Combined Fly Ash and Pozzolan: 25 percent.
 3. Slag Cement: 50 percent.
 4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing or plasticizing 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 w/c ratio below 0.50.
 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings and Foundation Walls: Normal-weight concrete.
1. Minimum Compressive Strength: 4500 psi at 28 days.
 2. Maximum W/C Ratio: 0.45.
 3. Slump Limit: 8 inches for concrete with verified slump of 4 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
- B. Slabs-on-Grade: Normal-weight concrete.
1. Minimum Compressive Strength: 4500 psi at 28 days.
 2. Maximum W/C Ratio: 0.45.
 3. Minimum Cementitious Materials Content: 470 lb/cu. yd.
 4. Slump Limit: 8 inches for concrete with verified slump of 4 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, 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 INSTALLATION

- 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 347 as abrupt or gradual, as follows:
 - 1. Class C, 1/2 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct 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 ITEM INSTALLATION

- 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 303.
 - 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 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting 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 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/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

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. Locate vertical joints in walls 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 does 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 Section 079200 "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 are completed.

- 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 is 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 not to 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.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1-part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1-part portland cement and 1-part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches

adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. 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 restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- C. 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.
 - 2. Finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.
- D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, 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.
- E. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. 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.
- F. 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.
- G. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct concrete bases 6 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4500 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

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 305.1 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 remainder of 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 does 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. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does 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 LIQUID FLOOR TREATMENT APPLICATION

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than seven days' old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.12 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 joints clean and dry.
- C. Install semi rigid 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.

3.13 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 1-part portland cement to 2-1/2 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 to solid concrete. Limit cut depth to 3/4 inch. 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 matches 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.

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: 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/C 172M 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 provides 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/C 231M, 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 or 80 deg F and above, and one test for each composite sample.
 6. Unit Weight: ASTM C 567/C 567M, 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.

3.15 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

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. Concrete masonry units.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
- C. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties.
 - 2. Reinforcing bars.
 - 3. Joint reinforcement.
 - 4. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.

2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

- E. Statement of Compressive Strength of Masonry: 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 TMS 602/ACI 530.1/ASCE 6.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

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. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

- A. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

2.4 CONCRETE MASONRY UNITS

- A. CMUs: ASTM C 90.
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi .
 2. Density Classification: Normal weight.
 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.5 MORTAR AND GROUT MATERIALS

- A. Coordinate requirements in this article with those in "Mortar and Grout Mixes" Article.
- B. Portland Cement: ASTM C 150/C 150M, 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.
 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- E. Aggregate for Mortar: ASTM C 144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- F. Aggregate for Grout: ASTM C 404.
- G. Water: Potable.

2.6 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Interior Walls: Hot-dip galvanized carbon steel.
 - 2. Wire Size for Side Rods: 0.148-inch diameter.
 - 3. Wire Size for Cross Rods: 0.148-inch diameter.
 - 4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 5. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

2.7 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. For reinforced masonry, use portland cement-lime mortar.
- 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. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For reinforced masonry, use Type M.
- D. 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 TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
 - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that reinforcing dowels are properly placed.
 - 2. Verify that substrates are free of substances that impair mortar bond.
- 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 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
 - 2. 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.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
 - 4. 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.
 - 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
 - 6. 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.
 - 7. 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.
- C. Joints:
 - 1. For 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.

2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.
5. 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. Stopping and Resuming Work: Stop work by stepping 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 masonry if required before laying fresh masonry.
- D. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay CMUs as follows:
 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 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 in addition to continuous reinforcement.
- B. Provide continuity at wall intersections by using prefabricated T-shaped units.
- C. Provide continuity at corners by using prefabricated L-shaped units.
- D. Cut and bend reinforcing units as directed by manufacturer for continuity at [corners,] returns, offsets, , pipe enclosures, and other special conditions.

3.6 REINFORCED UNIT MASONRY INSTALLATION

- A. 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 TMS 602/ACI 530.1/ASCE 6 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.

3.7 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. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 4. Clean masonry by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

3.8 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.

END OF SECTION 042000

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Foam-plastic board insulation.
 - 2. Vapor retarders.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research/evaluation reports.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 1. 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:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Owens Corning.
 - d. Pactiv Building Products.
 - 2. Type X, 15 psi for vertical surfaces above grade.
 - 3. Type IV, 25 psi for vertical surfaces below grade.

2.2 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.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation 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. 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.

3.2 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 36 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.
 - 1. If not otherwise indicated, extend insulation a minimum of 36 inches in from exterior walls.

3.3 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

- B. 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 retarders.
- C. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

END OF SECTION 072100

SECTION 081113 - 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. Exterior standard steel doors and frames.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation 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.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.

8. Details of moldings, removable stops, and glazing.

- C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.35 deg Btu/F x h x sq. ft. when tested according to ASTM C 518.

2.2 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

- B. Maximum-Duty Doors and Frames: SDI A250.8, Level 4; SDI A250.4, Level A.

1. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
- b. Thickness: 1-3/4 inches.
- c. Face: Metallic-coated steel sheet, minimum thickness of 14 gauge, with minimum A60 prepared for coating with system specified in Section 099113 Exterior Painting.

- d. Edge Construction: Model 2, Seamless.
 - e. Edge Bevel: Bevel lock edge 1/8 inch in 2 inches.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: Polyisocyanurate.
2. Frames: Full profile welded customized frames with G90 hot dipped galvanizing after welding and primed with organic SSPC Paint 20 / MPI Paint 20 primer compatible with Satin 2k urethane topcoat specified in Section 099113 Exterior Painting.
- a. Materials: Metallic-coated steel sheet, minimum 14-gauge steel, with G90 hot dipped galvanizing after welding and prime with organic SSPC Paint 20 / MPI Paint 20 compatible with Satin 2k urethane topcoat specified in Section 099113 Exterior Painting.
 - b. Construction: Full profile welded.

2.3 FRAME ANCHORS

A. Jamb Anchors:

- 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
- 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
- 3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M G90 minimum.

2.4 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

2.5 FABRICATION

- A. Hollow-Metal Frames: Fabricate in one piece
- B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates except that cutouts, drilling, or any other modification shall be completed prior to galvanizing.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
 - 3. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware if any. Acquire non-templated hardware from supplier.
- C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
 - 2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 - 3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.6 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. G90 hot dipped galvanizing after welding and prepared to receive topcoat specified in Section 099113 Exterior Painting.

PART 3 - EXECUTION

3.1 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. Apply ASTM A780 / A780M repair paint and Touch up factory-applied finishes where spreaders are removed.

3.2 INSTALLATION

- A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with SDI A250.11.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 - 2. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8.

3.3 CLEANING AND TOUCHUP

- A. Touchup: Immediately after erection, Clean abraded areas and repair and apply repair paint in accordance with ASTM A780/A780M and touchup according to finish manufacturer's written instructions.

END OF SECTION 081113

SECTION 083323 - OVERHEAD COILING DOORS

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. Insulated exterior overhead coiling service doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
 - 5. Show locations of controls, locking devices, and other accessories.
 - 6. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
 - 1. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
 - 1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
 - 2. Testing: According to ASTM E 330/E 330M or DASMA 108 for garage doors and complying with acceptance criteria of DASMA 108.
 - 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

4. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 10-lbf/sq. ft. wind load, acting inward and outward.

B. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.0.

2.3 DOOR ASSEMBLY

A. Insulated Service Door: High Speed overhead coiling door formed with curtain of interlocking metal slats.

1. Basis of Design: Cornell-Cookson Extreme 1024 Insulated Door

2. Acceptable alternatives include Cookson and Clopay Building Products

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position. Design doors of construction for high cycle use of up to 1,000,000 cycles for the life of the product.

C. Operation Speed: Design doors of construction for high speed operation to achieve operational speed up to 24 inches per second open and up to 12 inches per second close

D. Air Infiltration: Minimum requirement should meet both of the following:

1. ASHRAE® (Standard 90.1-2007, 2010 & 2013 requirements of less than .3 CFM/FT²).

2. IECC® (International Energy Conservation Code) 2012 requirements of less than 1.0 CFM/FT²

E. System STC Rating: 21.

F. Curtain R-Value: 8.0 deg F x h x sq. ft./Btu.

G. Door Curtain Material: Galvanized steel.

H. Door Curtain Slats: Interconnected strip steel slats conforming to ASTM A-653, 15/16 inch thick.

1. Insulated-Slat Exterior Facing: 22 Gauge Galvanized steel.

2. Insulated-Slat Interior Facing: 22 Gauge Galvanized steel.

I. Bottom Bar: Two angles, each not less than 2 by 2 by 3/16-inch-thick; fabricated from hot-dip galvanized steel and finished to match door.

J. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

K. Endlocks: Fabricate interlocking sections with malleable steel endlocks on alternate slats each secured two 1/4" high strength low profile rivets. Windlock material as required based on

system description and manufacturer's recommendation. Provide windlocks as required to meet specified wind load.

- L. Hood: Match curtain material and finish and hood baffles.
 - 1. Shape: Manufacturer's standard.
 - 2. Mounting: As indicated on Drawings.
- M. Locking Devices: Equip door with chain keeper for padlock.
- N. Electric Door Operator:
 - 1. Usage Classification: High Speed, up to 1,000,000 cycles for the life of the product
 - 2. Operator Location: Wall.
 - 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded.
 - 4. Motor Exposure: Interior.
 - 5. Motor Electrical Characteristics:
 - a. Horse Power: 3 HP (18' Wide Doors) / 5 HP (28' Wide Doors)
 - b. Hertz: 60
 - c. Voltage: 460
 - d. Phase: 3
 - e. FLA: 4.2 (18' Wide Doors) / 6.6 (28' Wide Doors)
 - 6. Emergency Manual Operation: Chain type.
 - 7. Obstruction-Detection Device: Pneumatic sensor edge on bottom bar; self-monitoring type.
 - a. Sensor Edge Bulb Color: Black.
 - 8. Control Station(s): Interior mounted.
 - 9. Other Equipment: Audible and visual signals.
- O. Curtain Accessories: Equip door with weather seals and baffles inside of hood.
- P. Door Finish:
 - 1. Powder-Coated Finish: Color as selected by ERAA Representative from manufacturer's full range of standard and optional colors.
 - 2. Interior Curtain-Slat Facing: Finish as selected by ERAA Representative from manufacturer's full range.

2.4 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), interconnected strip steel slats; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 22 gauge; and as required.
 - 2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
 - 3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 22 gauge.
- B. Curtain Jamb Guides: Thermal break required. Minimum 3/16" thick ASTM A36 bolted together with 1/2" fasteners to form a channel for the curtain to travel. Sealing, self lubricating UHMW anti-wear strips and block materials provided. The wall angle portion shall be continuous and fastened to the surrounding structure with either minimum 1/2" fasteners or welds, both on 36" centers maximum. The guides must be pre-notched to allow accurate insertion of pre-assembled coil box
- C. Pre-Assembled Coil Box: Factory pre-assembled coil box to contain fully wrapped curtain on barrel and structurally supported brackets. Welded Truss shall brace endplates together at the top and bottom with steel channel and flatbar diagonal bracing.

2.6 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Galvanized Steel: 24 gauge galvanized steel with reinforced top and bottom edges.
 - 2. Finish: Powder coating system to include a galvanized base coat consistent with ASTM A-653, Zirconium treated and bonderized for prime coat adhesion, with a standard manufacturer powder coat color baked-on polyester powder coat, as selected by Architect, rust inhibiting paint with a minimum 2 mils (0.0508 mm) cured film thickness.

2.7 LOCKING DEVICES

- A. Chain Lock Keeper: Suitable for padlock.
- B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 CURTAIN ACCESSORIES

- A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8-inch-thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of rubber, or neoprene.
- B. Vision Panels: Provide oval acrylic panes set with double sided foam glazing tape to provide ambient light and allow visibility of oncoming traffic, refer to drawings for placement uniformly spaced and as shown the drawings.

2.9 SHAFT ASSEMBLY

- A. General: A Direct Connect Inertia Brake shall be mounted directly to the Drive Barrel shaft on the non-drive side to help prevent curtain free-fall. Engagement of the inertia brake shall disable the electrical control circuit. A chain driven inertia brake is not acceptable.
- B. Barrel: Minimum 6" steel tubing capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width
- C. Brackets: Constructed of steel not less than 5/16" thick and shall be bolted to the wall angle with minimum 1/2" fasteners. Both drive and tension brackets are to be furnished with precision ball bearings. The unitized barrel, bracket, and curtain unit to have a tension side access hatch feature to allow removal of barrel and bearing components for replacement or servicing.
 - 1. Finish: Powder Coat (Stock Color): Zirconium treatment followed by a dark bronze baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.

2.10 ELECTRIC DOOR OPERATORS

- A. General: Pro-FDG operator consisting of SEW Eurodrive, TEFC, brake motor/reducer with separate wall mounted control panel:
 - 1. PLC controller with variable frequency drive; soft-start and soft-stop at both ends of limit travel. Doors without a frequency drive will not accepted
 - 2. 460V (3-Phase)
 - 3. NEMA - 4/12 Wall Mounted Control Panel with OPEN/CLOSE/Mushroom Head Stop on Control Panel cover
 - 4. UL Listed operator with B2 Controls with 1.5 Sec delay on reverse and timer to close
 - 5. Flexible conduit on Wall Mounted Starter pre-populated will all wires (terminated and marked) necessary for interconnection between motor limit box and WMS Conduit to maintain same NEMA rating as selected above. Length to be equal to door height plus 3 feet.
 - 6. Run Time Limiting timer
 - 7. Primary Fuse Block inside panel

8. Circuit supplied for activation of warning annunciator when closing
 9. Non-resettable Cycle Counter
 10. Larger terminal blocks provided for high voltage /power supply connections
 11. Angled terminal blocks to simplify external field wiring connections
 12. High performance motor brake
 13. Motor selection, gear reducer gear-set and size, with sprocket and roller chain selection based on manufacturer's recommendation, capable of starting and stopping from any position in either direction
 14. Motor operator and control system shall be designed for a sustained continuous duty cycling
 15. SEW – Helical gear reducer
 16. Synthetic extended temperature gear oil in reducer for increased operating temperature range
 17. Powder Coated NEMA 4 limit box with terminal strip and Honeywell HD Limit Switches
 18. Limit sprockets and drive sprocket with QD Bushing installed on Operator
 19. Variable Frequency Drive with Braking Resistor
 20. Limit Chain and Sprockets
- B. Entrapment Protection: The following protection safety devices provided standard:
1. 1. UL325-2010 compliant NEMA 4X photo eye sensors consisting of a transmitter and receiver that are to be mounted within 6" (152.4 mm) of the floor, projecting an IR beam across the entire width of the door. Interruption of beam before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position.
 2. 2. SafetyGard™ Light Curtain Technology consisting of an integral 6' (1828.8mm) high light curtain, if where an object breaks the plane of the light curtain, the door reverses to the open position. Doors provided without a light curtain will not accepted.
- C. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- D. Door Operator Location(s): Operator location indicated for each door.
1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
- E. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.
1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

- F. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- G. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
 - 1. Pneumatic Sensor Edge: Automatic safety sensor edge, located within weather stripping mounted to bottom bar. Contact with sensor activates device.
- H. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 - 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- I. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- J. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- K. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- L. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with the accessibility standard.

2.11 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 STEEL AND GALVANIZED-STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's premium baked-on finish consisting of prime coat and EZ clean thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness. Provide custom color as scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.
- D. Power-Operated Doors: Install electric motors and controls according to UL 325.
- E. Remove all manufacturer's labels and logos from coiling door hood. Do not provide products that have manufacturer's name or trade name displayed in a visible location.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
 - 3. Test door closing when activated by detector or alarm-connected automatic-closing system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train ERAA representative maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 084513 - STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

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 aluminum-framed assemblies glazed with structured-polycarbonate panels as follows:
 - 1. Wall assemblies.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum components of panel assemblies.
- B. Shop Drawings: For panel assemblies.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
- C. Delegated-Design Submittal: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer testing agency.
- B. Product Test Reports: For each structured-polycarbonate-panel assembly, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For structured-polycarbonate-panel assemblies from ICC-ES.

D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For panel assemblies to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including, but not limited to, excessive deflection.
- b. Deterioration of metals and other materials beyond normal weathering.
- c. Water leakage.

2. Warranty Period: Five years from date of Substantial Completion.

B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace structured-polycarbonate panels that exhibit defects in materials or workmanship within specified warranty period.

1. Defects include, but are not limited to, the following:

- a. Delamination.
- b. Color changes exceeding requirements.
- c. Losses in light transmission beyond 6 percent from original when measured according to ASTM D 1003.

2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design structured-polycarbonate-panel assemblies.
- B. Structural Loads: As indicated on Drawings.
- C. Deflection Limits:
 - 1. Vertical Panel Assemblies: Limited to 1/120 of clear span for each assembly component.
- D. Structural-Test Performance: Panel assemblies tested according to ASTM E 330, as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified deflection limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Windborne-Debris-Impact-Resistance Performance: Panel assemblies that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and the testing information in ASTM E 1996 for Wind Zone 4.
 - 1. Large-Missile Test: For glazed openings located within 30 feet of grade.
- F. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- G. Water Penetration under Dynamic Pressure: Provide panel assemblies that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
 - 1. Maximum Water Leakage: According to AAMA 501.1 No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water that is controlled by flashing and gutters and drained to the exterior, or water that cannot damage adjacent materials or finishes.
- H. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations 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.

- I. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. Minimum Visible Light Transmittance: 37% as determined according to NFRC 202 & 201
 - 2. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.28 Btu/sq. ft. x h x deg F (0.08 Btu/sq. ft. x h x deg F COG) as determined according to NFRC 100.
 - 3. Solar-Heat-Gain Coefficient (SHGC): Fixed glazing and framing areas shall have an SHGC of no greater than 0.40 as determined according to NFRC 202 & 201.
 - 4. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.

2.2 STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

- A. Structured-Polycarbonate-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with structured-polycarbonate panels.

2.3 STRUCTURED-POLYCARBONATE PANELS

- A. Structured-Polycarbonate Panels: Translucent, extruded-polycarbonate sheet with multiwall cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.
 - 1. Cell Insulation: Fill cellular cross sections with aerogel.
- B. Panel Thickness: Nominal 3 inches.
- C. UV Resistance: On both surfaces.
- D. Color: Transparent, colorless.
- E. Panel Performance:
 - 1. Plastic Self-Ignition Temperature: 650 deg F or more according to ASTM D 1929.
 - 2. Smoke-Developed Index: 450 or less according to ASTM E 84, or 75 or less according to ASTM D 2843.
 - 3. Combustibility Classification: Class CC1 based on testing according to ASTM D 635.
 - 4. Interior Finish Classification: Class A based on testing according to ASTM E 84.
 - 5. Color Change: Not more than 3.0 units Delta E, when measured according to ASTM D 2244, after outdoor weathering compliant with procedures in ASTM D 1435.
 - a. Outdoor Weathering Conditions: 60 months in Arizona or 120 months in a moderate North American climate.
 - 6. Impact Resistance: No failure at impact of 200 ft. x lbf according to freefalling-ball impact test using a 3-1/2-inch-diameter, 6.3-lb ball.
 - 7. Haze Factor: Greater than 90 percent when tested according to ASTM D 1003.

2.4 ALUMINUM FRAMING SYSTEMS

- A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
 - 1. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429.
 - d. Structural Profiles: ASTM B 308.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.
- C. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.
 - 1. At closures, retaining caps, or battens, use ASTM A 193, 300 series stainless-steel screws.
 - 2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- D. Anchor Bolts: ASTM A 307, Grade A, galvanized steel.
- E. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- F. Exposed Flashing and Closures: Aluminum sheet not less than 0.040-inch-thick, finished to match framing.
- G. Framing Gaskets: Manufacturer's standard gasket system with low-friction surface treatment designed specifically for retaining structured-polycarbonate panels.
- H. Frame-System Sealants: As recommended in writing by manufacturer.
- I. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. Fabricate aluminum components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Internal guttering systems or other means to drain water passing through joints and moisture migrating within assembly to exterior.

- B. Fabricate aluminum sill closures with weep holes and for installation as continuous component.
- C. Reinforce aluminum components as required to receive fastener threads.

2.6 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by ERAA Representative from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions.
 - 1. Do not install damaged components.
 - 2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - 3. Rigidly secure nonmovement joints.
 - 4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
 - 5. Seal joints watertight unless otherwise indicated.
- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install components plumb and true in alignment with established lines and elevations.
- D. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
 - 1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
 - 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

3.3 FIELD QUALITY CONTROL

- A. Repair or remove work where inspections indicate that it does not comply with specified requirements.
- B. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Prepare inspection reports.

END OF SECTION 084513

SECTION 087100 - DOOR HARDWARE

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. Mechanical door hardware for the following:
 - a. Swinging doors.
- 2. Cylinders for door hardware specified in other Sections.

- B. Related Requirements:

- 1. Section 081113 "Hollow Metal Doors and Frames"

1.3 COORDINATION

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

- 1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware

schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.

2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
 3. Content: Include the following information:
 - a. Identification number, location, hand, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d. Fastenings and other installation information.
 - e. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - f. Mounting locations for door hardware.
 - g. List of related door devices specified in other Sections for each door and frame.
- C. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Architectural Hardware Consultant.
- B. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.
- B. Schedules: Final door hardware and keying schedule.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.

- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
 - a. Exit Devices: Two years from date of Substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of door hardware from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

B. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the DOT's "ADA Standards for Transportation Facilities" and ICC A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
3. Provide beveled raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.3 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.

1. Door hardware is scheduled in Part 3.

2.4 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

2.5 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Trim:

1. Description:.
2. Levers: Provide cast, construction..
3. Escutcheons (Roses): Provide cast, construction to match lever.

C. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

D. Mortise Locks: BHMA A156.13; Operational Grade 1 Security Grade 1; stamped steel case with steel or brass parts; Series 1000.

2.6 AUXILIARY LOCKS

- A. Mortise Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.
- B. Exit Devices and Auxiliary Items: BHMA A156.3.
 - 1. Manufacturers: Basis of Design products by DORMA USA, Inc.
 - a. For Single Doors (9300), Function F09 BHMA Type 1, F09. Rim Exit Device. Entrance by lever on each door only when released by key. Key removable only when locked.

2.7 LOCK CYLINDERS

- A. Lock Cylinders: Lock cylinders shall be an extension of the owners existing Best system. Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.
 - 1. Core Type: Best 7 Pin Intrchangable Cores. Format shall match existing
- C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
- D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.8 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.
 - 1. Existing System: Provide permanent cylinders keyed as an extension of the owners existing Best 7 Pin system.
 - a. Master key or grand master key locks to Owner's existing system.
 - 2. Keyed Alike: Key all cylinders to same change key.
- B. Keys: Nickel silver.
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE."

2.9 OPERATING TRIM

- A. Operating Trim: BHMA A156.6; 630 finish unless otherwise indicated.

2.10 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.11 MECHANICAL STOPS AND HOLDERS

- A. Wall-Mounted Stops: BHMA A156.16.

2.12 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
- B. Maximum Air Leakage: When tested according to ASTM E 283 with tested pressure differential of 0.3-inch wg, as follows:
 - 1. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.

2.13 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

2.14 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

2.15 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location or as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 - 3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.16 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of 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 are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, wall and floor construction, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.3 INSTALLATION

- A. Install each door hardware item to comply with manufacturer's 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. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- B. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent.
- C. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
- D. Key Control System:
 - 1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- F. Stops: Provide stops built into door closer arms unless indicated otherwise.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - 1. Do not notch perimeter gasketing to install other surface-applied hardware.
- H. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 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.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SCHEDULE

Set: 1.0 Exterior Door:

3	Butt Hinges	A8112 NRP 4-1/2" x 4-1/2"	630
1	Storeroom Lock	F07	630
1	Cylinder	SFIC Housing and Trim Rings	626
1	Cylinder Core	SFIC as Specified	626
1	Closer	C02021 PT 4C, PT 4G	689
1	Wall Stop	L02101	630
1	Kick Plate	J102 8" x 2" LDW B4E CSK	630
1	Door Gasket	R3E165 (Head & Jambs)	
1	Threshold	J36130 (Pemko 278x224_FGT	630

Set: 2.0 Exterior Door:

3	Butt Hinges	A8112 NRP 4-1/2" x 4-1/2"	630
1	Exit Device	Type 1, Function 04	630
1	Cylinder	SFIC Housing and Trim Rings	626
1	Cylinder Core	SFIC as Specified	626
1	Closer	C02021 PT 4C, PT 4G	689
1	Kick Plate	J102 8" x 2" LDW B4E CSK	630
1	Door Gasket	R3E165 (Head & Jambs)	
1	Threshold	J36130 (Pemko 278x224_FGT	630

END OF SECTION 087100

SECTION 099113 - EXTERIOR PAINTING

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 surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel and iron.
 - 2. Galvanized metal.

1.3 DEFINITIONS

- A. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide basis of design system or an approved equal of basis of design listed in the Exterior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. Material Compatibility:
 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. Materials for use within each paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As selected by ERAA Representative from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 4. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Steel and Iron Substrates:
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Primer, MPI #134.
 - 1) Sherwin Williams Pro Industrial Pro-Cryl Universal Primer, B66N00310, minimum 8.0 mils wet 3 mils dry
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - 1) Sherwin Williams Pro Industrial Waterbased Alkyd Urethane, B53-1150, 4.0 mils wet, 1.6 mils dry.
 - c. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5)

- 1) Sherwin Williams Pro Industrial Waterbased Alkyd Urethane, B53-1150, 4.0 mils wet, 1.6 mils dry.

B. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer, MPI #134.

- 1) Sherwin Williams Pro Industrial Pro-Cryl Universal Primer, B66N00310, minimum 8.0 mils wet 3 mils dry

b. Intermediate Coat: Alkyd, interior, matching topcoat.

- 1) Sherwin Williams Pro Industrial Waterbased Alkyd Urethane, B53-1150, 4.0 mils wet, 1.6 mils dry.

c. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5)

- 1) Sherwin Williams Pro Industrial Waterbased Alkyd Urethane, B53-1150, 4.0 mils wet, 1.6 mils dry.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete masonry units (CMUs).
 - 2. Galvanized metal.

1.3 DEFINITIONS

- A. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. Insert number of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

- A. Products: Subject to compliance with requirements, provide product listed in the Interior Painting Schedule for the paint category indicated or an approved equal meeting performance and VOC requirements.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by ERAA Representative from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Masonry (Clay and CMUs): 12 percent.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
1. SSPC-SP 2.
 2. SSPC-SP 3.
 3. SSPC-SP 7/NACE No. 4.
 4. SSPC-SP 11.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces. Confirm compatibility of shop primer with specified paint system. Remove shop primer not approved by the paint system manufacturer and apply specified system primer.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 4. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Work:
1. Paint the following work where exposed
 - a. Uninsulated metal piping.
 - b. Pipe hangers and supports.
 - c. Metal conduit.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

Manufacturers systems listed provide a basis of design with performance requirements including: low volatile organic content, adhesion, pencil hardness, flexibility, block resistance, and resistance to yellowing. Substitutions are meeting or exceeding the performance of the basis of design system.

A. CMU Substrates:

1. Waterbased Alkyd Urethane over Block Filler:

- a. Block filler, latex, interior/exterior, MPI #4.
 - 1) Sherwin Williams Pro Industrial Heavy-Duty Block Filler B42W00150.
- b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - 1) Sherwin Williams Pro Industrial Waterbased Alkyd Urethane, B53-1250, 4.0 mils wet, 1.6 mils dry.
- c. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 4).
 - 1) Sherwin Williams Pro Industrial Waterbased Alkyd Urethane, B53-1250, 4.0 mils wet, 1.6 mils dry.

B. Galvanized-Metal Substrates:

1. Waterbased Alkyd Urethane over Galvanized Primer System:

- a. Prime Coat: Primer, MPI #134.
 - 1) Sherwin Williams Pro Industrial Pro-Cryl Universal Primer, B66N00310, minimum 8.0 mils wet 3 mils dry
- b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - 1) Sherwin Williams Pro Industrial Waterbased Alkyd Urethane, B53-1150, 4.0 mils wet, 1.6 mils dry.
- c. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5)
 - 1) Sherwin Williams Pro Industrial Waterbased Alkyd Urethane, B53-1150, 4.0 mils wet, 1.6 mils dry.

C. Wood Substrates Panel Backer Boards:

1. Waterbased Alkyd Urethane System:
 - a. Prime Coat: Primer sealer, interior.
 - 1) Sherwin Williams Premium Wall & Wood Primer, B28W08111, 4.0 mils wet 1.6 mils dry
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - 1) Sherwin Williams Pro Industrial Waterbased Alkyd Urethane, B53-1250, 4.0 mils wet, 1.6 mils dry.
 - c. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 4).
 - 1) Sherwin Williams Pro Industrial Waterbased Alkyd Urethane, B53-1250, 4.0 mils wet, 1.6 mils dry.

END OF SECTION 099123

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Regular Dry-Chemical Type in Steel Container: UL-rated 120-B:C, 20-lb nominal capacity, with sodium bicarbonate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated finish.
 - 1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 133419 - METAL BUILDING 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. Section Includes:

1. Structural-steel framing
2. Crane rails.
3. Guide rails
4. Metal roof panels.
5. Foamed-insulation-core metal wall panels.
6. Thermal insulation.
7. Personnel doors and frames.
8. Accessories.

B. Related Requirements:

1. Section 083323 "Overhead Coiling Doors" for coiling vehicular doors in metal building systems.
2. Section 084513 "Structured-Polycarbonate-Panel Assemblies" for translucent panels in metal building systems.

1.3 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.4 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to metal building systems including, but not limited to, the following:
 - a. Condition of foundations and other preparatory work performed by other trades.
 - b. Structural load limitations.
 - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Required tests, inspections, and certifications.
 - e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.
2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
 - b. Structural limitations of purlins and rafters during and after roofing.
 - c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
 - d. Temporary protection requirements for metal roof panel assembly during and after installation.
 - e. Roof observation and repair after metal roof panel installation.
3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
 - b. Structural limitations of girts and columns during and after wall panel installation.
 - c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 - d. Temporary protection requirements for metal wall panel assembly during and after installation.
 - e. Wall observation and repair after metal wall panel installation.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Metal roof panels.
 - b. Foamed-insulation-core metal panels.
 - c. Thermal insulation and vapor-retarder facings.
 - d. Personnel doors and frames.

- e. Louvers.
 - B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
 - 1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
 - 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
 - 3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 - a. Show wall-mounted items including personnel doors, vehicular doors, translucent panels, louvers, and lighting fixtures.
 - 4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
 - C. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.
 - 1. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.
 - 2. Keying Schedule: Detail ERAA's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
 - D. Delegated-Design Submittal: For metal building systems.
 - 1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.
- 1.7 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For erector manufacturer land surveyor.
 - B. Welding certificates.

- C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - 1. Name and location of Project.
 - 2. Order number.
 - 3. Name of manufacturer.
 - 4. Name of Contractor.
 - 5. Building dimensions including width, length, height, and roof slope.
 - 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - 7. Governing building code and year of edition.
 - 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 - 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- D. Erector Certificates: For qualified erector, from manufacturer.
- E. Material Test Reports: For each of the following products:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shop primers.
 - 5. Nonshrink grout.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.
- I. Sample Warranties: For special warranties.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panel finishes and door hardware to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.

1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Land Surveyor Qualifications: A professional land surveyor who practices in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.
1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- 1.10 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Protect foam-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 foam-plastic insulation materials to Project site before installation time.
 3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.12 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

- 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

- 2. Finish Warranty Period: 25 years from date of Substantial Completion.

- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.

- 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

- B. Primary-Frame Type:

- 1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
- 2. Rigid Modular: Solid-member, structural-framing system with interior columns.
- 3. Truss-Frame Clear Span: Truss-member, structural-framing system without interior columns.
- 4. Truss-Frame Modular: Truss-member, structural-framing system with interior columns.
- 5. Lean-to: Solid- or truss-member, structural-framing system, designed to be partially supported by another structure.

- C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.

- D. Secondary-Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.
- E. Eave Height: As indicated on Drawings.
- F. Bay Spacing: As indicated on Drawings.
- G. Roof Slope: 1/2 inch per 12 inches.
- H. Roof System: Manufacturer's structural standing-seam, vertical-rib, metal roof panels.
- I. Exterior Wall System: Manufacturer's standard foamed-insulation-core metal wall panels.
 - 1. Liner Panels: Tapered rib.

2.2 RUNWAY SYSTEM AND CRANE RAIL

- A. Provide structural steel and crane rail as required to accommodate the crane specified in Section 412213 BRIDGE CRANES, OVERHEAD ELECTRIC, TOP RUNNING.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.
- B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual." And as required to support the dynamic loads of the crane provided.
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
 - 3. Deflection and Drift Limits: No greater than the following:
 - a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
 - b. Girts: Horizontal deflection of 1/180 of the span.
 - c. Metal Roof Panels: Vertical deflection of 1/240 of the span.
 - d. Metal Wall Panels: Horizontal deflection of 1/180 of the span.
 - e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - f. Lateral Drift: Maximum of 1/200 of the building height and as required for the crane.
- C. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- E. Fire Propagation Characteristics: Exterior wall assemblies containing foam plastics pass NFPA 285 fire test.
- F. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.
- G. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 or ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft..
- H. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft..
- I. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft..
- J. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft..
- K. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90 and as required to meet ASCE 7 in compliance with ICC-IBC code requirements.
- L. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
 - 1. Fire/Windstorm Classification: Class 1A- 90.
 - 2. Hail Resistance: SH.
- M. Thermal Performance for Opaque Elements: Provide the following maximum U-factors and minimum R-values when tested according to ASTM C 1363 or ASTM C 518:

1. Roof: in combination with faced batt insulation
 - a. U-Factor: 0.0333.
 - b. R-Value: R-13 + R-11 with 1.5-inch thermal blocks.
2. Walls:
 - a. U-Factor: .050
 - b. R-Value: 13 + R-5.6ci.

2.4 STRUCTURAL-STEEL FRAMING

- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
 2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
 3. Frame Configuration: Single gable.
 4. Exterior Column: Tapered.
 5. Rafter: Tapered.
- E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
 1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
 2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
- F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

1. Purlins: Z-shaped sections except where C shaped are indicated or required; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch-wide flanges.
 - a. Depth: As needed to comply with system performance requirements without increasing the height of the building or reducing the clearance of the crane hook.
 2. Purlins: Steel joists of depths indicated on Drawings.
 3. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch-wide flanges.
 - a. Depth: As required to comply with system performance requirements.
 4. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
 5. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch-diameter, cold-formed structural tubing to stiffen primary-frame flanges.
 6. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
 7. Base or Sill Angles: Manufacturer's standard base angle, minimum 3-by-2-inch, fabricated from zinc-coated (galvanized) steel sheet.
 8. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
 9. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
 10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- G. Bracing: Provide adjustable wind bracing using any method as follows:
1. Rods: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50; or ASTM A 529/A 529M, Grade 50; minimum 1/2-inch-diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
 2. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
 3. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
 4. Fixed-Base Columns: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
 5. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
- H. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.
- I. Materials:
1. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.

2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
3. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
4. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
5. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.
6. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70; or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80, or HSLAS, Grades 45 through 70.
7. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G60 coating designation; mill phosphatized.
8. Metallic-Coated Steel Sheet Pre-painted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G90 coating designation.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, SS, Grade 50 or 80; with Class AZ50 coating.
9. Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for primary framing.
10. Steel Joists: Manufactured according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for secondary framing.
11. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.
 - a. Finish: Hot-dip zinc coating, ASTM F 2329, Class C.
12. Structural Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563 heavy-hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - a. Finish: Hot-dip zinc coating, ASTM F 2329, Class C.
13. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with spline ends; ASTM A 563 heavy-hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
14. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with spline ends.

- a. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.
15. Unheaded Anchor Rods: ASTM F 1554, Grade 36/ASTM A 307, Grade A.
- a. Configuration: Straight.
 - b. Nuts: ASTM A 563 heavy-hex carbon steel.
 - c. Plate Washers: ASTM A 36/A 36M carbon steel.
 - d. Washers: ASTM F 436 hardened carbon steel.
 - e. Finish: Hot-dip zinc coating, ASTM F 2329, Class C.
16. Headed Anchor Rods: ASTM F 1554, Grade 36.
- a. Configuration: Straight.
 - b. Nuts: ASTM A 563 heavy-hex carbon steel.
 - c. Plate Washers: ASTM A 36/A 36M carbon steel.
 - d. Washers: ASTM F 436 hardened carbon steel.
 - e. Finish: Hot-dip zinc coating, ASTM F 2329, Class C.
17. Threaded Rods:
- a. Nuts: ASTM A 563 heavy-hex carbon steel.
 - b. Washers: ASTM F 436 hardened carbon steel.
 - c. Finish: Hot-dip zinc coating, ASTM F 2329, Class C.
- J. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating. ASTM A 36/A 36M
- 1. Clean and prepare in accordance with SSPC-SP2.
 - 2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.
 - a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.
- 2.5 GUARDRAILS
- A. Guardrail System: Provide galvanized steel beam guide rail elements and fittings of the indicated design and details. The finished beam elements must be Class A (base metal nominal thickness 2.67 mm 0.105 inch and conform to the requirements of AASHTO M180). Galvanizing of steel beam elements must be Type 1 (zinc coated 550 grams per square meter 1.80 ounces per square foot, minimum single spot) and must conform to the requirements of AASHTO M 180.
- B. Steel H Posts: Provide fabricated "H" beam sections from steel conforming to either ASTM A36/A36M, ASTM A588/A588M or ASTM A242/A242M and conforming to the size, weight and dimensions required. Bolts used with galvanized ASTM A36/A36M steel must conform to ASTM A307. ASTM F3125/F3125M, Type 3 bolts may be used with ASTM A588/A588M or A242/A242M steel without galvanizing. Galvanize bolts, posts, and all necessary hardware fabricated from ASTM A36/A36M steel in accordance with ASTM A123/A123M. Provide ½" galvanized base plates welded to steel H posts with flanges and pre-drilled holes for attachment to concrete slab.

2.6 METAL ROOF PANELS

- A. Standing-Seam, Trapezoidal-Rib, Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
1. Material: ASTM A 792/A 792M aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: Two-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
 2. Clips: One-piece fixed to accommodate thermal movement.
 3. Joint Type: Mechanically seamed.
 4. Panel Coverage: 24 inches.
 5. Panel Height: 3 inches.
 6. Uplift Rating: UL 90.
- B. Finishes:
1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.7 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
1. Panel Thermal-Resistance Value (R-Value): 20
 2. Panel U-Factor maximum 0.050
 3. Facing Material: Fabricate panel with exterior and interior facings of same material and thickness. ASTM A 792/A 792M aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Surface: Shallow ribs.
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 4. Panel Coverage: nominal.

5. Panel Thickness: 2 inches.
6. Insulation Core: Modified polyisocyanurate or polyurethane foam using a non-CFC blowing agent, foamed-in-place or board type, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
 - a. Closed-Cell Content: 90 percent when tested according to ASTM D 6226.
 - b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D 1622.
 - c. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
 - d. Shear Strength: 26 psi when tested according to ASTM C 273/C 273M.
7. Fire-Test-Response Characteristics: Class A according to ASTM E 108.
8. Surface-Burning Characteristics: Flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E 84.

B. Finishes:

1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.8 THERMAL INSULATION

- A. Faced Metal Building Insulation: ASTM C 991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch-wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
- B. Unfaced Metal Building Insulation: ASTM C 991, Type I, or NAIMA 202, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch-wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
- C. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm when tested according to ASTM E 96/E 96M, Desiccant Method.
 1. Composition: White polypropylene film facing, fiberglass scrim reinforcement, and metallized-polyester film backing.
- D. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.9 PERSONNEL DOORS AND FRAMES

- A. Swinging Personnel Doors and Frames: As specified in Section 081113 "Hollow Metal Doors and Frames."

2.10 TRANSLUCENT PANELS

- A. Insulated Translucent Panels: Provide framing, flashing and sealants as required and coordination as required for the installation of Insulated Translucent Panels specified in Section 084513 - Structured-Polycarbonate-Panel Assemblies.

2.11 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

- 1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

- 1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
- 2. Clips: Manufacturer's standard, formed from ASTM A 792/A 792M coated steel sheet, designed to withstand negative-load requirements.
- 3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from ASTM A 792/A 792M coated steel sheet.
- 4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- 5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- 6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch standoff; fabricated from extruded polystyrene.

- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

- 1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
- 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or

premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, pre-painted with coil coating; finished to match adjacent metal panels.
1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 2. Opening Trim: ASTM A 792/A 792M aluminum-zinc alloy-coated steel sheet, 0.030-inch nominal uncoated steel thickness, pre-painted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, pre-painted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters.
 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, pre-painted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Materials:
1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - a. Concealed Fasteners for Metal Roof Panel clip: Self-drilling or self-tapping, ceramic coated, aluminum-zinc-plated, carbon-steel screws.
 - b. Concealed Fasteners for Metal Wall Panels: Self-drilling or self-tapping, ceramic coated, aluminum-zinc-plated, carbon-steel screws.
 - c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with
 - d. Self-drilling ceramic coated, aluminum-zinc-plated, carbon-steel screws.
 - e. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
 3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
 4. Metal Panel Sealants:

- a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
- b. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.12 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
 - 1. Make shop connections by welding or by using high-strength bolts.
 - 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 - 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 - 4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
 - 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
 - 1. Make shop connections by welding or by using non-high-strength bolts.
 - 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.13 SOURCE QUALITY CONTROL

- A. Special Inspection: Owner may engage a qualified special inspector to perform source quality control inspections and to submit reports.
 - 1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.
 - a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
 - 1. Engage land surveyor to perform surveying.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

- D. Base and Bearing 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 plates for structural members on wedges, shims, or setting nuts as required.
 - 2. 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.
 - 3. 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.

- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. 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 will be completed and in service.

- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
 - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.

- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
 - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 - 2. Locate and space wall girts to suit openings such as doors and windows.
 - 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

- H. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

- I. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 GUARDRAIL INSTALLATION

- A. Posts may be placed by setting in excavated holes. Post holes for guardrail posts must be round and at least 4 inches larger, in diameter, than the greater dimensions (not the diagonal) of the posts, and must be backfilled around the posts with material removed or other suitable soil, placed in lifts not exceeding 4 inches, each lift thoroughly tamped. Set in such manner that

nearby structures are not damaged. Cuts and abrasions in preservative-treated posts and blocks must have the newly exposed surfaces treated with at least three applications of the same type of preservative with which the material was originally treated. Each application must be reasonably dry before the succeeding coat is applied. At the time a timber post is installed, any seasoning check which extends the full length of the piece cannot exceed 1/4 inch in width. Adjust posts used for vertical transition in length so that a minimum of 60 inches will be buried. Where guardrail cross buried structures and 60 inches of bury is not obtainable, install the guardrail post as deep as possible and with a 24inch diameter concrete encasement for the full depth of bury.

- B. Guardrail Beam Elements: Place and fasten the beam elements, fittings, and other parts of the guardrail as indicated. Erect the elements to produce a smooth, even rail, closely conforming to a line and grade parallel to the pavement. Bolt the beam elements to each post, and make splices by lapping in the direction of traffic. Splice only at posts.

3.5 METAL PANEL INSTALLATION, GENERAL

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 - 1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 - 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
 - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Locate metal panel splices over structural supports with end laps in alignment.
 - 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

- E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
 - 1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
 - 1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.6 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
 - 1. Install ridge caps as metal roof panel work proceeds.
 - 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
 - 1. Install clips to supports with self-drilling or self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 - 4. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
 - 5. Provide metal closures at peaks rake edges each side of ridge caps.
- C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

- D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 - 2. Shim or otherwise plumb substrates receiving metal wall panels.
 - 3. When two rows of metal panels are required, lap panels 4 inches minimum.
 - 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 - 5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Pre-drill panels.
 - 6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 - 7. Install screw fasteners in predrilled holes.
 - 8. Install flashing and trim as metal wall panel work proceeds.
 - 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
 - 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
 - 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum 42 inches o.c., spaced not more than manufacturer's recommendation. Fully engage tongue and groove of adjacent insulated metal wall panels.
 - 1. Install clips to supports with self-tapping fasteners.
 - 2. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels as weather seal.
- C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, noncumulative; level, plumb, and on location lines; and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 THERMAL INSULATION INSTALLATION

- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.

1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
 - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

3.9 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- B. Personnel Doors and Frames: Install doors and frames according to NAAMM-HMMA 840. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
 1. Between Doors and Frames at Jambs and Head: 1/8 inch.
 2. Between Edges of Pairs of Doors: 1/8 inch.
 3. At Door Sills with Threshold: 3/8 inch.
 4. At Door Sills without Threshold: 3/4 inch.
- C. Door Hardware:
 1. Install surface-mounted items after finishes have been completed at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 4. Set thresholds for exterior doors in full bed of sealant complying with requirements for concealed mastics specified in Section 079200 "Joint Sealants."

3.10 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
1. Tie downspouts to underground drainage system indicated.
- E. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
 2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
 3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
 4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.11 FIELD QUALITY CONTROL

- A. Special Inspections: Owner may engage a qualified special inspector to perform field quality control special inspections and to submit reports.
- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.12 ADJUSTING

- A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.
- B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

3.13 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
 - 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- D. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
 - 1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- E. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.
 - 1. Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 133419

SECTION 211316 - DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Specialty valves.
 - 3. Sprinkler specialty pipe fittings.
 - 4. Sprinklers.
 - 5. Alarm devices.
 - 6. Manual control stations.
 - 7. Pressure gages.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For dry-pipe sprinkler systems.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For dry-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which items of other systems and equipment are shown and coordinated with each other, using input from installers of the items involved.
- B. Design Data:
 - 1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:

- 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

- A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.

2.2 PERFORMANCE REQUIREMENTS

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- C. Delegated Design: Engage a qualified professional NICET, to design dry-pipe sprinkler systems.
 - 1. Available fire-hydrant flow test records indicate the following conditions:
 - a. Date: 04/04/2018
 - b. Time: 11:30 A.M.
 - c. Performed by: Sumeet Jadhav of Michael Baker International
 - d. Location of Residual Fire Hydrant R: Airside
 - e. Location of Flow Fire Hydrant F: Landside
 - f. Static Pressure at Residual Fire Hydrant R: 50 psig.
 - g. Measured Flow at Flow Fire Hydrant F: 888 gpm.
 - h. Residual Pressure at Residual Fire Hydrant R: 20 psig.
- D. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 20 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:
 - a. Automobile Parking Areas: Ordinary Hazard, Group 1
3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1950-sq. ft. area.
4. Maximum Protection Area per Sprinkler: According to UL listing.
5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
 - a. Ordinary-Hazard Occupancies: 250 gpm for 90 minutes

2.3 STEEL PIPE AND FITTINGS

- A. Standard-Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E or Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Galvanized-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Thinwall Galvanized-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- D. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- E. Galvanized-Steel Couplings: ASTM A 865/A 865M, threaded.
- F. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- G. Malleable- or Ductile-Iron Unions: UL 860.
- H. Cast-Iron Flanges: ASME B16.1, Class 125.
- I. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.
- J. Grooved-Joint, Steel-Pipe Appurtenances:
 1. Pressure Rating: 175-psig minimum.
 2. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
 3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.4 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Specialty Valves Pressure Rating: 175-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Dry-Pipe Valves:
 - 1. Standard: UL 260.
 - 2. Design: Differential-pressure type.
 - 3. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - 4. Air Compressor:
 - a. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
 - b. Motor Horsepower: Fractional.
 - c. Power: 208-V ac, 60 Hz, single phase.
- G. Automatic (Ball Drip) Drain Valves:
 - 1. Standard: UL 1726.
 - 2. Pressure Rating: 175-psig minimum.
 - 3. Type: Automatic draining, ball check.
 - 4. Size: NPS 3/4.
 - 5. End Connections: Threaded.

2.5 SPRINKLER PIPING SPECIALTIES

- A. General Requirements for Dry-Pipe System Fittings: UL listed for dry-pipe service.
- B. Branch Outlet Fittings:
 - 1. Standard: UL 213.
 - 2. Pressure Rating: 175-psig minimum.
 - 3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 - 4. Type: Mechanical-tee and -cross fittings.
 - 5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
 - 6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
 - 7. Branch Outlets: Grooved, plain-end pipe, or threaded.
- C. Flow Detection and Test Assemblies:
 - 1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
 - 2. Pressure Rating: 175-psig minimum.

3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

D. Branch Line Testers:

1. Standard: UL 199.
2. Pressure Rating: 175-psig minimum.
3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

E. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

F. Adjustable Drop Nipples:

1. Standard: UL 1474.
2. Pressure Rating: 250-psig minimum.
3. Body Material: Steel pipe with EPDM O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

G. Flexible Sprinkler Hose Fittings:

1. Standard: UL 1474.
2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
3. Pressure Rating: 175-psig minimum.
4. Size: Same as connected piping, for sprinkler.

2.6 SPRINKLERS

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
 1. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes: Chrome plated, bronze and painted.
- E. Special Coatings: Wax, lead and corrosion-resistant paint.

2.7 MANUAL CONTROL STATIONS

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.
- B. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.8 PRESSURE GAGES

- A. Standard: UL 393.
- B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- C. Pressure Gage Range: 0- to 250-psig minimum.
- D. Label: Include "WATER" or "AIR/WATER" label on dial face.
- E. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.2 WATER-SUPPLY CONNECTIONS

- A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.3 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install automatic (ball drip) drain valves to drain piping between fire department connections and check valves. Drain to floor drain or to outside building.
- J. Connect compressed-air supply to dry-pipe sprinkler piping.
- K. Connect air compressor to the following piping and wiring:
1. Pressure gages and controls.
 2. Electrical power system.
 3. Fire-alarm devices, including low-pressure alarm.
- L. Install alarm devices in piping systems.
- M. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13. In seismic-rated areas.
- N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.
- O. Drain dry-pipe sprinkler piping.
- P. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors.
- R. Install sleeve seals for piping penetrations of concrete walls and slabs.

- S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install dry-pipe valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - a. Install air compressor and compressed-air-supply piping.
 - b. Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.
 - c. Install compressed-air-supply piping from building's compressed-air piping system.

3.6 SPRINKLER INSTALLATION

- A. Install sprinklers with water supply from heated space. Do not install pendant or sidewall, sprinklers in areas subject to freezing.
- B. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.7 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 4. Energize circuits to electrical equipment and devices.
 5. Start and run air compressors.
 6. Coordinate with fire-alarm tests. Operate as required.
 7. Coordinate with fire-pump tests. Operate as required.
 8. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

- C. Prepare test and inspection reports.

3.9 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.10 PIPING SCHEDULE

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded or grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Standard-pressure, dry-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
 - 1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - 2. Standard-weight, galvanized-steel pipe with plain ends; plain-end-pipe fittings; and twist-locked joints.
 - 3. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- D. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 and larger, shall be one of the following:
 - 1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - 2. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.11 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
 - 1. Rooms without Ceilings: Upright sprinklers.
 - 2. Spaces Subject to Freezing: Upright sprinklers, Dry pendent sprinklers, or Dry sidewall sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
 - 1. Upright and Pendent Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211316

SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 Annex G and NSF 372.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.18 for solder-joint connections.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valves in Insulated Piping:
 - 1. Include 2-inch stem extensions.
 - 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.

2.2 BRONZE BALL VALVES

- A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim:

1. 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:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. NIBCO INC.
 - c. WATTS.
2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded or soldered.
 - f. Seats: PTFE.
 - g. Stem: Bronze or brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Full.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

END OF SECTION 220523.12

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Copper Pipe and Tube Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 THERMAL HANGER-SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. For Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- E. Install lateral bracing with pipe hangers and supports to prevent swaying.
- F. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- G. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- I. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Use thermal hanger-shield insert with clamp sized to match OD of insert.
 - b. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal hanger-shield inserts may be used.
 - 3. Shield Dimensions for Pipe: Not less than the following:
 - a. 12 inches long and 0.048 inch thick.
 - 4. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Use thermal hanger-shield inserts for insulated piping and tubing.
- G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
- H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 5. C-Clamps (MSS Type 23): For structural shapes.
 6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 10. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- K. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

PART 3 - EXECUTION

3.1 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.2 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Domestic Water Piping
 - a. Background: Safety green.
 - b. Letter Colors: White.
2. Sanitary Waste and Vent Piping:
 - a. Background: Safety green.
 - b. Letter Colors: White.
3. Gas Piping:
 - a. Background Color: Safety yellow.
 - b. Letter Color: Black.

END OF SECTION 220553

SECTION 221113 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes water-distribution piping and related components within five feet of the building for combined water service and fire-service mains.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- F. NSF Compliance:
 - 1. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of water-distribution service without Construction Manager's written permission.

1.7 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See Section 330500 "Common Work Results for Utilities" for piping-system common requirements.

3.4 PIPING INSTALLATION

- A. Comply with NFPA 24 for fire-service-main piping materials and installation.
- B. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- C. Bury piping with top at least 12 inches below level of maximum frost penetration.
- D. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 - 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- E. Provide mechanical sleeve seals at floor penetrations.
- F. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.5 JOINT CONSTRUCTION

- A. See Section 330500 "Common Work Results for Utilities" for basic piping joint construction.
- B. Make pipe joints according to the following:
 - 1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
 - 2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
 - 3. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.6 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 1. Concrete thrust blocks.
 - 2. Locking mechanical joints.
 - 3. Set-screw mechanical retainer glands.
 - 4. Bolted flanged joints.
 - 5. Heat-fused joints.
 - 6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.

- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.7 CONNECTIONS

- A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.
- B. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.8 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- C. Prepare reports of testing activities.

3.9 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

3.10 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

- a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
- b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
- c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
- d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copper tube and fittings.
 - 2. Piping joining materials.
 - 3. Transition fittings.
 - 4. Dielectric fittings.
- B. Related Requirements:
 - 1. Section 221113 "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.2 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G.
- C. Comply with NSF 372 for low lead.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Nipples:

1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F 1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction

loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements in Section 221119 "Domestic Water Piping Specialties."
- D. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- E. Install domestic water piping level without pitch and plumb.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- H. Install piping to permit valve servicing.
- I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

3.3 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: MSS Type 1, adjustable, steel clevis hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

3.6 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 4. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 5. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.9 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

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. Backflow preventers.
 2. Strainers.
 3. Hose bibbs.
 4. Wall hydrants.
 5. Drain valves.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61.
- B. Comply with NSF 372 for low lead.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. Flomatic Corporation.
 - c. WATTS.
 - 2. Standard: ASSE 1013.
 - 3. Operation: Continuous-pressure applications.
 - 4. Pressure Loss: 12 psig maximum, through middle third of flow range.
 - 5. Body: Bronze
 - 6. End Connections: Threaded
 - 7. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
 - 1. Pressure Rating: 125 psig minimum unless otherwise indicated.
 - 2. Body: Bronze
 - 3. End Connections: Threaded
 - 4. Screen: Stainless steel with round perforations unless otherwise indicated.
 - 5. Perforation Size: 0.020 inch.
 - 6. Drain: Factory-installed, hose-end drain valve.

2.5 HOSE BIBBS

- A. Hose Bibbs:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. WATTS.
 - 2. Standard: ASME A112.18.1 for sediment faucets.
 - 3. Body Material: Bronze.
 - 4. Seat: Bronze, replaceable.
 - 5. Supply Connections: NPS 3/4 threaded.
 - 6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
 - 7. Pressure Rating: 125 psig.

8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish: Rough bronze
10. Operation: Wheel handle

2.6 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. WATTS.
2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Wheel handle.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Nozzle and Wall-Plate Finish: Polished nickel bronze.

2.7 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

PART 3 - EXECUTION

3.1 INSTALLATION

- #### A. Backflow Preventers: Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe

diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.

3. Do not install bypass piping around backflow preventers.

B. Y-Pattern Strainers: install on outlet of backflow preventer.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

C. Comply with requirements for grounding equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

3.3 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 221119

SECTION 221123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 65 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

2.2 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.3 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
 - 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 - 2. Operating-Pressure Rating: 0.5 psig.
 - 3. End Fittings: Zinc-coated steel.
 - 4. Threaded Ends: Comply with ASME B1.20.1.
 - 5. Maximum Length: 72 inches
- B. Y-Pattern Strainers:
 - 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 - 2. End Connections: Threaded ends for NPS 2 and smaller.
 - 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
 - 4. CWP Rating: 125 psig.

2.4 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.

2.5 DIELECTRIC UNIONS

- A. Dielectric Unions:
 - 1. Description:

- a. Standard: ASSE 1079.
- b. Pressure Rating: 125 psig minimum at 180 deg F.
- c. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- S. Do not use natural-gas piping as grounding electrode.
- T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- U. Paint all gas piping safety yellow. Refer to Section 099123 - Interior Painting.

3.2 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of flexible connector.
- B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.3 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

3.5 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Connect piping to equipment using manual gas shutoff valves and unions. Install valve within 24 inches of each gas-fired appliance and equipment. Install union between valve and equipment.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.6 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

3.7 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to NFPA 54, the International Fuel Gas Code and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 INDOOR PIPING SCHEDULE

- A. Aboveground, distribution piping shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.

END OF SECTION 221123

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. PVC pipe and fittings.
 - 2. Hubless cast-iron soil pipe and fittings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 PVC PIPE AND FITTINGS

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

- C. Cellular-Core PVC Pipe is prohibited.
- D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- E. Adhesive Primer: ASTM F 656.
- F. Solvent Cement: ASTM D 2564.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI-Trademark, Shielded Couplings:
 - 1. Description: ASTM C 1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Shielded Couplings:
 - 1. Description: ASTM C 1277 and ASTM C 1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 NONPRESSURE-TYPE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling; for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and include corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings:
 - 1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Ring-Type, Flexible Couplings:
 - 1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
- E. Nonpressure-Type, Rigid Couplings:
 - 1. Description: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling; molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 - 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 - 3. Do not change direction of flow more than 90 degrees.
 - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.
- K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 3. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install aboveground PVC piping according to ASTM D 2665.
- N. Install underground PVC piping according to ASTM D 2321.
- O. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
 - a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
 2. Install drains in sanitary waste gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs.
1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
 - 1. Plumbing drains and specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.5 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.6 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.7 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.8 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil, waste, and vent piping shall be the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
- C. Underground, soil, waste, and vent piping shall be any of the following:
 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cleanouts.

1.2 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

2.2 CLEANOUTS

- A. Cast-Iron Exposed Floor Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Company.
 - c. Sioux Chief Manufacturing Company, Inc.
 - 2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
 - 3. Size: Same as connected branch.
 - 4. Body or Ferrule: Cast iron.
 - 5. Clamping Device: Not required.
 - 6. Outlet Connection: Spigot.
 - 7. Closure: Brass plug with tapered threads.
 - 8. Adjustable Housing Material: Cast iron with threads.
 - 9. Frame and Cover Material and Finish: Enameled cast iron.
 - 10. Frame and Cover Shape: Round.
 - 11. Top Loading Classification: Extra Heavy Duty.
 - 12. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

2.3 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:

1. 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:
 - a. Acorn Engineering Company.
 - b. Thaler Metal Industries Ltd.
2. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 - a. Open-Top Vent Cap: Without cap.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200, Sheet Metal Flashing and Trim.
- E. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200, Sheet Metal Flashing and Trim.
- F. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- G. Install vent caps on each vent pipe passing through roof.
- H. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.3 FLASHING INSTALLATION

- A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.
- C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- D. Set flashing on floors and roofs in solid coating of bituminous cement.
- E. Secure flashing into sleeve and specialty clamping ring or device.
- F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."
- G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
 - 1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221319.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Floor drains.
 - 2. Trench drains.

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene styrene.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene.
- D. PE: Polyethylene.
- E. PP: Polypropylene.
- F. PVC: Polyvinyl chloride.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
 - 1. 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:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Company.

- c. Zurn
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Outlet: Bottom.
6. Top or Strainer Material: Gray iron.
7. Top Shape: Round.
8. Trap Material: Cast iron.
9. Trap Pattern: Standard P-trap.
10. Refer to drawing schedules for additional information
11. Provide funnel inlet connection for HVAC condensate drains. Coordinate locations with Mechanical Contractor.

2.3 TRENCH DRAINS

- A. Trench Drains:
 1. 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:
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Company.
 - c. Zurn
 2. Standard: ASME A112.6.3 for trench drains.
 3. Material: Fiberglass reinforced plastic.
 4. Flange: Not required.
 5. Clamping Device: Not required.
 6. Outlet: Catch Basin
 7. Refer to drawing schedules for additional information

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 3. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

- B. Install trench drains at low points of surface areas to be drained.
 - 1. Set grates of drains flush with finished surface, unless otherwise indicated.
 - 2. Install on support devices, so that top will be flush with adjacent surface.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements in Section 221323 "Sanitary Waste Interceptors" for grease interceptors, grease-removal devices, oil interceptors, sand interceptors, and solid interceptors.
- C. Install piping adjacent to equipment to allow service and maintenance.
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

SECTION 221323 - SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Oil interceptors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of interceptor.
- B. Shop Drawings: For each type and size of precast concrete interceptor indicated.
 - 1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Interceptors, drawn to scale, and coordinated with each other, using input from installers of the items involved:
 - 1. Piping connections. Include size, location, and elevation of each.
 - 2. Interface with underground structures and utility services.

PART 2 - PRODUCTS

2.1 OIL INTERCEPTORS

- A. Factory-fabricated; buried, precast concrete with baffles, vents, and flow-control fitting on inlet.
 - 1. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
 - 2. Cover: Cast iron or steel, with steel reinforcement to provide ASTM C 890, A-16 (HS20-44) heavy traffic load.

2.2 PRECAST CONCRETE MANHOLE RISERS

- A. Precast Concrete Manhole Risers: ASTM C 478, with rubber-gasket joints.
 - 1. Structural Design Loads:
 - a. Heavy-Traffic Load: Comply with ASTM C 890, A-16.
 - 2. Length: From top of underground concrete structure to grade.
 - 3. Riser Sections: 3-inch minimum thickness and 36-inch diameter.
 - 4. Top Section: Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
 - 5. Gaskets: ASTM C 443, rubber.

6. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals.
- B. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, diameter matching manhole frame and cover, and height as required to adjust the manhole frame and cover to indicated elevation and slope.
- C. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover.
 1. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
 2. Gray Iron: ASTM A 48/A 48M, Class 35, unless otherwise indicated.
 3. Include indented top design with lettering cast into cover, using wording equivalent to the following:
 - a. Oil Interceptors in Sanitary Sewerage System: "OIL INTERCEPTOR SANITARY SEWER."

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 INSTALLATION

- A. Install precast concrete interceptors according to ASTM C 891.
- B. Set interceptors level and plumb.
- C. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.
- D. Set tops of manhole frames and covers flush with finished surface in pavements.
- E. Set tops of grating frames and grates flush with finished surface.
- F. Install piping and oil storage tanks according to Section 231113 "Facility Fuel-Oil Piping."
- G. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Make piping connections between interceptors and piping systems.

3.4 IDENTIFICATION

- A. Identification materials and installation are specified in Section 312000 "Earth Moving."
 - 1. Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
 - 2. Use warning tapes or detectable warning tape over ferrous piping.
 - 3. Use detectable warning tape over nonferrous piping and over edges of underground structures.

- B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign near each of the following:
 - 1. Oil interceptors.

END OF SECTION 221323

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
 2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
 2. Split phase.
 3. Capacitor start, inductor run.
 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.

- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230523.12 - BALL VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded-end valves.
- C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream piping unless otherwise indicated.
- F. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

- A. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:
 - 1. 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:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. Crane; Crane Energy Flow Solutions.
 - c. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.

- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel.
- j. Port: Full.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

END OF SECTION 230523.12

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Equipment supports.

- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.3 TRAPEZE PIPE HANGERS

- ### A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 EQUIPMENT SUPPORTS

- ### A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.5 MATERIALS

- ### A. Aluminum: ASTM B 221.
- ### B. Carbon Steel: ASTM A 1011/A 1011M.
- ### C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- ### D. Stainless Steel: ASTM A 240/A 240M.
- ### E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.
- E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- F. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

- H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- O. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Section 099123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers, supports and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 3. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 5. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 7. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.

2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 4. C-Clamps (MSS Type 23): For structural shapes.
 5. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 6. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 7. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 8. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 9. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

END OF SECTION 230529

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment labels.
 2. Warning signs and labels.
 3. Pipe labels.
 4. Duct labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 2. Letter Color: White.
 3. Background Color: Black.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Paint all piping. Refer to Section 099123 "Interior Painting."
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.

1.3 ACTION SUBMITTALS

- A. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.4 INFORMATIONAL SUBMITTALS

- A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- B. Certified TAB reports.

1.5 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.
- B. TAB Specialists Qualifications: Certified by NEBB or TABB.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.

- 2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB as a TAB technician.

- C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

- B. Examine the approved submittals for HVAC systems and equipment.

- C. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

- D. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

- E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

- F. Examine test reports specified in individual system and equipment Sections.

- G. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

- H. Examine operating safety interlocks and controls on HVAC equipment.

- I. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.

- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Fans are operating, free of vibration, and rotating in correct direction.
 - b. Variable-frequency controllers' startup is complete and safeties are verified.
 - c. Automatic temperature-control systems are operational.
 - d. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or ASHRAE 111 or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- C. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set dampers for proper position that simulates operating conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
 - 1. Measure airflow of submain and branch ducts.
 - 2. Adjust submain and branch duct volume dampers for specified airflow.
 - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
 - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 - 2. Measure inlets and outlets airflow.
 - 3. Adjust each inlet and outlet for specified airflow.
 - 4. Re-measure each inlet and outlet after they have been adjusted.

3.6 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
 - 1. Fans: Plus or minus 10 percent
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.7 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
 2. Manufacturers' test data.
 3. Field test reports prepared by system and equipment installers.
 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB specialist.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Fan drive settings including settings and percentage of maximum pitch diameter.
 - b. Other system operating conditions that affect performance.
- D. Gas-Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btu/h.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and rpm.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.

2. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Entering-air static pressure in inches wg.
 - c. Leaving-air static pressure in inches wg.
 - d. Air static-pressure differential in inches wg.
 - e. Low-fire fuel input in Btu/h.
 - f. High-fire fuel input in Btu/h.
 - g. Manifold pressure in psig.
 - h. High-temperature-limit setting in deg F.
 - i. Operating set point in Btu/h.
 - j. Motor voltage at each connection.
 - k. Motor amperage for each phase.
 - l. Heating value of fuel in Btu/h.

- E. Fan Test Reports: For fans, include the following:
 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.

- F. Instrument Calibration Reports:
 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

END OF SECTION 230593

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Control dampers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 CONTROL DAMPERS

- A. Frames:
 - 1. Hat or U shaped.
 - 2. 0.094-inch- thick, galvanized sheet steel.
 - 3. Interlocking, gusseted corners.

- B. Blades:
 - 1. Multiple blade with maximum blade width of 6 inches.
 - 2. Parallel-blade design.
 - 3. Galvanized-steel.
 - 4. 0.064 inch thick single skin or 0.0747-inch- thick dual skin.
 - 5. Blade Edging: Closed-cell neoprene.
 - 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- C. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
 - 1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- D. Bearings:
 - 1. Molded synthetic.
 - 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 3. Thrust bearings at each end of every blade.
- E. Accessories
 - 1. Electric actuators

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Propeller fans.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 PROPELLER FANS

- A. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- B. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- C. Fan Wheel: Replaceable, cast or extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

- D. Fan Drive: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

- E. Fan Drive:
 - 1. Resiliently mounted to housing.
 - 2. Statically and dynamically balanced.
 - 3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - 4. Extend grease fitting to accessible location outside of unit.
 - 5. Service Factor Based on Fan Motor Size: 1.4.
 - 6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - 7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 100,000 hours.
 - 8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
 - 9. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 10. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - 11. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

- F. Accessories:
 - 1. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
 - 2. Wall Sleeve: G90 Galvanized steel to match fan and accessory size.
 - 3. Weathershield Hood: Galvanized steel to match fan and accessory size.
 - 4. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

- G. Controls
 - 1. Dual technology occupancy sensors (EF-1)
 - a. Provide sensors across building to sense occupancy at any point within bay.
 - 2. Wall mounted thermostat (EF-2)
 - 3. Combination carbon-monoxide / nitrogen dioxide sensors and transmitters (EF-2)
 - a. Description:
 - 1) Electrochemical with a typical minimum sensor life of 5 years (CO) and 3 years (NO₂)
 - 2) Alarm points:
 - a) 25 & 100 ppm CO
 - b) 1 & 3 ppm NO₂
 - 3) Contact closure on relay at warning alarm points to activate exhaust fan
 - 4) 95 dBa Audio alarm at high alarm points
 - b. Construction:
 - 1) NEMA 250, Type 1 enclosure for wall-mounted space applications.
 - 2) Equip with digital display for continuous indication of gas concentration.
 - 3) Warning and Alarm lights on panel
 - c. Performance:
 - 1) Measurement Range:
 - a) 0 to 100 ppm CO
 - b) 0-10 ppm NO₂
 - d. Provide calibration kit. Turn over to Owner at start of warranty period.

2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units with clearances for service and maintenance.
- B. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Install ducts adjacent to power ventilators to allow service and maintenance.
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 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.

- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 233423

SECTION 235523.13 - LOW-INTENSITY, GAS-FIRED, RADIANT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes low-intensity, gas-fired, draft-induced radiant heaters.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of radiant heaters that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: All warranty periods listed below are from date of Substantial Completion.
 - a. Burner Assembly: Three years.
 - b. Combustion and Emitter Tubes: Two years.
 - c. Heater Controls: Two years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. CSA certified, with CSA Seal and certification number clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.
- B. UL listed and labeled, with UL label clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DRAFT-INDUCED HEATERS

- A. Description: Factory-assembled, indoor, overhead-mounted, electrically controlled, low-intensity, infrared radiant heating units using gas combustion. Heater to have all necessary factory-installed wiring and piping required prior to field installation and startup.
- B. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.
- C. Burner Assembly:
 - 1. Combustion-Air Inlet: Non-ducted, unvented.
 - 2. Combustion-Air Inlet: Ducted horizontal to outdoors through sidewall with vent caps.
 - 3. Combustion-Air Inlet: Ducted vertical to outdoors through roof with vent caps.
 - 4. Ignition System: Direct spark with flame rod sensing capabilities and self-diagnostic control module.
- D. Combustion Chamber: 4-inch- diameter, 16-gage, aluminized hot-rolled-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish.
- E. Emitter Tube: 4-inch- diameter, 16-gage, aluminized hot-rolled-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish.
 - 1. Tubing Connections: Compression couplings made from aluminized or stainless steel.
 - 2. 90-degree-bend emitter steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish.
- F. Vacuum Exhaust Fan: Dynamically balanced, direct-driven, isolated from emitter tubing exhaust system by high-temperature flexible vibration isolation connector. Fan and connector to have a minimum temperature rating of 450 deg F.
 - 1. Motors: General requirements for motors are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 2. Balancing Dampers: Plate type, mounted in cast, double-flange fitting with vacuum test plug.
 - 3. Filter: Cartridge type for mounting on burner housing.
 - 4. Vent Termination: Horizontal though side-wall with vent caps.

- G. Reflector: Polished aluminum, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Reflectors or entire heater shall accommodate rotational adjustment from horizontal to a minimum 30-degree tilt from vertical.

2.3 CONTROLS AND SAFETIES

- A. Gas Control Valve: Single-stage, regulated redundant 24-V ac gas valve that contains pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
- B. Failure Safeguards: 100 percent shutoff of gas flow in the event of flame or power failure.
- C. Prepurge of 30 seconds of air control system prior to burner ignition.
- D. Safety lockout of burner after three consecutive ignition failures.
- E. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.
- F. Control Panel Interlock: Stops burner if panel is open.
- G. Indicator Lights: "Airflow-on" and "burner-on" indicator lights.
- H. Thermostat: Single-stage, wall-mounted type with 50 to 90 deg F operating range and fan on switch.
 - 1. Control Transformer: Integrally mounted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment Installation: Install gas-fired, radiant heaters and associated gas features and systems according to NFPA 54.
- B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.
 - 1. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- C. Maintain manufacturers' recommended clearances for combustibles.
- D. Gas Piping: Comply with Section 231123 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
 - 1. Gas Connections: Connect gas piping to radiant heaters according to NFPA 54 and manufacturer's instructions.
- E. Where installing piping adjacent to gas-fired, radiant heaters, allow space for service and maintenance.

- F. Electrical Connections: Comply with applicable requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 - 1. Install electrical devices furnished with heaters but not specified to be factory mounted.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Verify bearing lubrication.
 - 3. Verify proper motor rotation.
 - 4. Test Reports: Prepare a written report to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- B. Gas-fired, radiant heaters will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.3 ADJUSTING

- A. Adjust initial-temperature set points.
- B. Adjust burner and other unit components for optimum heating performance and efficiency.

END OF SECTION 235523.13

SECTION 238239.16 - PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes gas-fired propeller unit heaters.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include location and size of each field connection.
 - 4. Include details of anchorages and attachments to structure and to supported equipment.
 - 5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
 - 6. Indicate location and arrangement of piping valves and specialties.
 - 7. Indicate location and arrangement of integral controls.
 - 8. Wiring Diagrams: Power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.3 HOUSINGS

- A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.4 FAN AND MOTOR

- A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.
- B. Motor: Permanently lubricated, multispeed. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.5 CONTROLS

- A. Control Devices:
 - 1. Unit-mounted thermostat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install propeller unit heaters to comply with NFPA 90A.

- B. Install propeller unit heaters level and plumb.
- C. Suspend propeller unit heaters from structure with all-thread hanger rods and elastomeric hangers.
- D. Provide unit with manufacturer's recommended flue gas vent. Terminate in accordance with the International Mechanical Code.

3.3 CONNECTIONS

- A. Install piping adjacent to machine to allow service and maintenance.
- B. Comply with safety requirements in UL 1995.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections
 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 238239.16

SECTION 260513 - MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cables and related cable splices, terminations, and accessories for medium-voltage (2001 to 35,000 V) electrical distribution systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cable. Include splices and terminations for cables and cable accessories.
- B. Samples: 16-inch (400-mm) lengths for each type of cable specified.
- C. Sustainable Design Submittals:
 - 1. Product Data: For each conductor and cable indicating lead content.
 - 2. Product Data: For solvents and adhesives, indicating VOC content.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with IEEE C2 and NFPA 70.
- C. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.2 CABLES

- 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. Aetna Insulated Wire, Inc.
 - 2. General Cable; General Cable Corporation.
 - 3. Kerite Co. (The).

4. Okonite Company (The).
5. Prysmian Power Cables and Systems USA, LLC.
6. Rome Cable Corporation.
7. Southwire Company.

B. Cable Type: Type MV 90.

C. Conductor Insulation: Crosslinked polyethylene.

1. Voltage Rating: 5 kV.
2. Insulation Thickness: 100 percent insulation level.

D. Conductor: Copper.

E. Comply with UL 1072, AEIC CS8, ICEA S-93-639/NEMA WC 74, and ICEA S-97-682, and ICEA S-94-649.

F. Conductor Stranding: Compact round, concentric lay, Class B.

G. Strand Filling: Conductor interstices are filled with impermeable compound.

H. Lead Content: Less than 300 parts per million.

I. Shielding: Solid copper wires, helically applied over semiconducting insulation shield.

J. Shielding and Jacket: Corrugated copper drain wires embedded in extruded, chlorinated, polyethylene jacket.

K. Three-Conductor Cable Assembly: Three insulated, shielded conductors cabled together with ground conductors.

L. Cable Jacket: Sunlight-resistant PVC.

2.3 CONNECTORS

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. 3M.
2. Adalet.
3. Cooper Power Systems, an Eaton business.
4. DSG-Canusa.
5. Engineered Products Company.
6. G&W Electric Company.
7. MP Husky USA Cable Tray & Cable Bus.
8. Raychem; Pentair Thermal Management.
9. Scott Fetzer Co. (The).
10. TE Connectivity Ltd.

- B. Comply with ANSI C119.4 for connectors between aluminum conductors or for connections between aluminum to copper conductors.
- C. Copper-Conductor Connectors: Copper barrel crimped Copper shear bolt connectors.

2.4 SOLID TERMINATIONS

- 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. 3M.
 - 2. Adalet.
 - 3. Cooper Power Systems, an Eaton business.
 - 4. DSG-Canusa.
 - 5. Engineered Products Company.
 - 6. G&W Electric Company.
 - 7. MP Husky USA Cable Tray & Cable Bus.
 - 8. Raychem; Pentair Thermal Management.
 - 9. Scott Fetzer Co. (The).
 - 10. TE Connectivity Ltd.
- B. Multiconductor Cable Sheath Seals: Type recommended by seal manufacturer for type of cable and installation conditions, including orientation.
 - 1. Cold-shrink sheath seal kit with preformed sleeve openings sized for cable and insulated conductors.
 - 2. Heat-shrink sheath seal kit with phase- and ground-conductor re-jacketing tubes, cable-end sealing boot, and sealing plugs for unused ground-wire openings in boot.
- C. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class shall be equivalent to that of cable. Include shield ground strap for shielded cable terminations.
 - 1. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone-rubber, insulator modules; shield ground strap; and compression-type connector.
 - 2. Class 2 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, and compression-type connector. Include cold-shrink-rubber sleeve moisture seal for end of insulation whether or not supplied with kits.

2.5 SEPARABLE INSULATED CONNECTORS

- A. Description: Modular system with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
- B. 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. 3M.
 2. Cooper Power Systems, an Eaton business.
 3. DSG-Canusa.
 4. Engineered Products Company.
 5. G&W Electric Company.
 6. MP Husky USA Cable Tray & Cable Bus.
 7. Raychem; Pentair Thermal Management.
 8. Scott Fetzer Co. (The).
 9. TE Connectivity Ltd.
- C. Standard: Comply with IEEE 386.
- D. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.
- E. Load-Break Cable Terminators: Elbow-type units with 200-A-load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- F. Dead-Break Cable Terminators: Elbow-type unit with 200-A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- G. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.
1. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
 2. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
 3. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.
 4. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.
- H. Test-Point Fault Indicators: Applicable current-trip ratings and arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.
- I. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

2.6 SPLICE KITS

- A. Description: For splicing medium voltage cables; type as recommended by cable or splicing kit manufacturer for the application.
- B. 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. 3M.
 - 2. Adalet.
 - 3. Cooper Power Systems, an Eaton business.
 - 4. G&W Electric Company.
 - 5. MP Husky USA Cable Tray & Cable Bus.
 - 6. Raychem; Pentair Thermal Management.
 - 7. TE Connectivity Ltd.
- C. Standard: Comply with IEEE 404.
- D. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, materials, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.

2.7 MEDIUM-VOLTAGE TAPES

- A. Description: Electrical grade, insulating tape for medium voltage application.
- B. 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. 3M.
 - 2. Adalet.
 - 3. Cooper Power Systems, an Eaton business.
 - 4. DSG-Canusa.
 - 5. Engineered Products Company.
 - 6. G&W Electric Company.
 - 7. MP Husky USA Cable Tray & Cable Bus.
 - 8. Raychem; Pentair Thermal Management.
 - 9. Scott Fetzer Co. (The).
 - 10. TE Connectivity Ltd.
- C. Ethylene/propylene rubber-based, 30-mil (0.76-mm) splicing tape, rated for 130 deg C operation. Minimum 3/4 inch (20 mm) wide.
- D. Silicone rubber-based, 12-mil (0.30-mm) self-fusing tape, rated for 130 deg C operation. Minimum 1-1/2 inches (38 mm) wide.
- E. Insulating-putty, 125-mil (3.175-mm) elastic filler tape. Minimum 1-1/2 inches (38 mm) wide.

2.8 ARC-PROOFING MATERIALS

- 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. 3M.
 - 2. Adalet.
 - 3. Cooper Power Systems, an Eaton business.
 - 4. DSG-Canusa.
 - 5. Engineered Products Company.
 - 6. G&W Electric Company.
 - 7. MP Husky USA Cable Tray & Cable Bus.
 - 8. Raychem; Pentair Thermal Management.
 - 9. Scott Fetzer Co. (The).
 - 10. TE Connectivity Ltd.

- B. Tape for First Course on Metal Objects: 10-mil- (250-micrometer-) thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.

- C. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch (8 mm) thick, and compatible with cable jacket.

- D. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1 inch (25 mm) wide.

2.9 SOURCE QUALITY CONTROL

- A. Test and inspect cables according to ICEA S-97-682 before shipping.

- B. Test strand-filled cables for water-penetration resistance according to ICEA T-31-610, using a test pressure of 5 psig (35 kPa).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cables according to IEEE 576.

- B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inches (1200 to 1800 mm) on the pull rope.
 - 1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.
 - 2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the

pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.

- C. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - 1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.
 - 2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.
 - 3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.
 - 4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- F. Install direct-buried cables on leveled and tamped bed of 3-inch- (75-mm-) thick, clean sand. Separate cables crossing other cables or piping by a minimum of 2 inches (50 mm) of tamped earth, plus an additional 2 inches (50 mm) of sand. Install permanent markers at ends of cable runs, changes in direction, and buried splices.
- G. Install "buried-cable" warning tape 12 inches (305 mm) above cables.
- H. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.
- I. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.
- J. Install cable splices at pull points and elsewhere as indicated; use standard kits. Use dead-front separable watertight connectors in manholes and other locations subject to water infiltration.
- K. Install terminations at ends of conductors, and seal multiconductor cable ends with standard kits.
- L. Install separable insulated-connector components as follows:
 - 1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
 - 2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.
 - 3. Standoff Insulator: At each terminal junction, with one on each terminal.
- M. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:
 - 1. Clean cable sheath.
 - 2. Wrap metallic cable components with 10-mil (250-micrometer) pipe-wrapping tape.

3. Smooth surface contours with electrical insulation putty.
 4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
 5. Band arc-proofing tape with two layers of 1-inch- (25-mm-) wide half-lapped, adhesive, glass-cloth tape at each end of the arc-proof tape.
- N. Seal around cables passing through fire-rated elements according to Section 078413 "Penetration Firestopping."
- O. Install fault indicators on each phase where indicated.
- P. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.
- Q. Ground shields of shielded cable at one point only. Maintain shield continuity and connections to metal connection hardware at all connection points.
- R. Identify cables according to Section 260553 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
 2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
 3. Perform Partial Discharge test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
 4. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
- B. Prepare test and inspection reports.

END OF SECTION 260513

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- 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. Alcan Products Corporation; Alcan Cable Division.
 - 2. Alpha Wire.
 - 3. Belden Inc.
 - 4. Encore Wire Corporation.
 - 5. General Cable Technologies Corporation.
 - 6. Southwire Incorporated.

7. Or equal.

- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2 or Type XHHW-2.
- D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

- 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. AFC Cable Systems, Inc.
 - 2. Gardner Bender.
 - 3. Hubbell Power Systems, Inc.
 - 4. Ideal Industries, Inc.
 - 5. IlSCO; a branch of Bardes Corporation.
 - 6. NSi Industries LLC.
 - 7. O-Z/Gedney; a brand of the EGS Electrical Group.
 - 8. 3M; Electrical Markets Division.
 - 9. Tyco Electronics.
 - 10. Or equal.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN-2/THWN-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.
- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2 or XHHW-2, single conductors in raceway.
- D. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.
- F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2 or XHHW-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 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-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
 - 1. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- 1. Test wells.
- 2. Ground rods.
- 3. Ground rings.

- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Comply with UL 467 for grounding and bonding materials and equipment.

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. Burndy; Part of Hubbell Electrical Systems.
 - 2. Dossert; AFL Telecommunications LLC.
 - 3. ERICO International Corporation.

4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; A Brand of the EGS Electrical Group.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.
11. Or equal.

2.2 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 1. Solid Conductors: ASTM B 3.
 2. Stranded Conductors: ASTM B 8.
 3. Tinned Conductors: ASTM B 33.
 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet .

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors.
 - 3. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

- G. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated item, extending around the perimeter of area or item indicated.
 - 1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
 - 2. Bury ground ring not less than 24 inches from building's foundation.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.

- C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.

1.6 QUALITY ASSURANCE

- A. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 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. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Atkore International.
 - g. Wesanco, Inc.
 - h. Or equal.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

- 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) Hilti, Inc.
 - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.
 - 5) Or equal.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 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) Cooper B-Line, Inc.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti, Inc.
 - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 6) Or equal.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps .

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES 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. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- 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. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit.
 - 3. Anamet Electrical, Inc.
 - 4. Electri-Flex Company.
 - 5. O-Z/Gedney.
 - 6. Picoma Industries.
 - 7. Republic Conduit.
 - 8. Robroy Industries.
 - 9. Southwire Company.

10. Thomas & Betts Corporation.
 11. Western Tube and Conduit Corporation.
 12. Wheatland Tube Company.
 13. Or equal.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. FMC: Comply with UL 1; zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: compression.
 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- 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. AFC Cable Systems, Inc.
 2. Anamet Electrical, Inc.
 3. Aruco Corporation.
 4. CANTEX Inc.
 5. CertainTeed Corporation.
 6. Condux International, Inc.
 7. Electri-Flex Company.
 8. Kraloy.
 9. Lamson & Sessions; Carlon Electrical Products.
 10. Niedax-Kleinhaus USA, Inc.
 11. RACO; Hubbell.
 12. Thomas & Betts Corporation.
 13. Or equal.

- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. ENT: Not Used
- D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 BOXES, ENCLOSURES, AND CABINETS

- 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. Adalet.
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 3. EGS/Appleton Electric.
 - 4. Erickson Electrical Equipment Company.
 - 5. FSR Inc.
 - 6. Hoffman.
 - 7. Hubbell Incorporated.
 - 8. Kraloy.
 - 9. Milbank Manufacturing Co.
 - 10. Mono-Systems, Inc.
 - 11. O-Z/Gedney.
 - 12. RACO; Hubbell.
 - 13. Robroy Industries.
 - 14. Spring City Electrical Manufacturing Company.
 - 15. Stahlin Non-Metallic Enclosures.
 - 16. Thomas & Betts Corporation.
 - 17. Wiremold / Legrand.
 - 18. Or equal.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Metal Floor Boxes:
 - 1. Material: sheet metal.
 - 2. Type: Fully adjustable.
 - 3. Shape: Rectangular.

4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep and 4 inches by 2-1/8 inches by 2-1/8 inches deep.
- H. Gangable boxes are allowed.
- I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 1. Exposed Conduit: GRC or IMC.
 2. Concealed Conduit, Aboveground: GRC or IMC.
 3. Underground Conduit: RNC, Type EPC-40-PVC.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 1. Exposed, Not Subject to Physical Damage: EMT.
 2. Concealed in Ceilings and Interior Walls and Partitions: EMT or MC Cable.
 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 4. Boxes and Enclosures: NEMA 250, Type 1.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.

3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

3.2 INSTALLATION

- A. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- B. Complete raceway installation before starting conductor installation.
- C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run between pull points. Support within 12 inches of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches of enclosures to which attached.
- H. Raceways Embedded in Slabs:
 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete.
 5. Change from RNC, Type EPC-40-PVC, to GRC or IMC before rising above floor.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Coat field-cut threads on PVC-coated steel raceway with a corrosion-preventing conductive compound prior to assembly.
- K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

- M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- Q. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- R. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC in damp or wet locations not subject to severe physical damage.
- S. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.
- T. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- U. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- V. Locate boxes so that cover or plate will not span different building finishes.
- W. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- X. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- Y. Set metal floor boxes level and flush with finished floor surface.
- Z. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products 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."

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
1. Material: Galvanized sheet steel.
 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Carbon steel.
 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Presealed Systems.
 - b. or equal.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 - 2. Sealant shall have VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Sealant 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. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.

- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

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 Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment identification labels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a black background. Minimum letter height shall be 3/8 inch.

2.2 CABLE TIES

- A. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F.
 - 5. Color: Black.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.

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 and feeder conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. 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. 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: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 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. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - c. Enclosed switches.
 - d. UPS equipment.

END OF SECTION 260553

SECTION 260573.19 - ARC-FLASH HAZARD ANALYSIS

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 a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.3 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- G. SCCR: Short-circuit current rating.
- H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- I. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form:
 - 1. Arc-flash study input data, including completed computer program input data sheets.
 - 2. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
 - 3. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Power Systems Analysis Software Developer.
 - 2. For Power System Analysis Specialist.
 - 3. For Field Adjusting Agency.
- B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. Provide maintenance procedures in equipment manuals according to requirements in NFPA 70E.
 - 2. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.7 QUALITY ASSURANCE

- A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.
- D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.
 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- E. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.
- G. Field Adjusting Agency Qualifications:
1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
 2. A member company of NETA.
 3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

- 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. CGI CYME.
 2. EDSA Micro Corporation.
 3. ESA Inc.
 4. Operation Technology, Inc.
 5. Power Analytics, Corporation.
- B. Comply with IEEE 1584 and NFPA 70E.
- C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
 2. Conductor types, sizes, and lengths.
 3. Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
 4. Motor and generator designations and kVA ratings.
 5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
- F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."
- G. Arc-Flash Study Output Reports:
1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.
- H. Incident Energy and Flash Protection Boundary Calculations:
1. Arcing fault magnitude.
 2. Protective device clearing time.
 3. Duration of arc.
 4. Arc-flash boundary.
 5. Restricted approach boundary.
 6. Limited approach boundary.
 7. Working distance.
 8. Incident energy.
 9. Hazard risk category.
 10. Recommendations for arc-flash energy reduction.
- I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch (76-by-127-mm) self-adhesive equipment label for each work location included in the analysis.
- B. Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 - 1. Location designation.
 - 2. Nominal voltage.
 - 3. Protection boundaries.
 - a. Arc-flash boundary.
 - b. Restricted approach boundary.
 - c. Limited approach boundary.
 - 4. Arc flash PPE category.
 - 5. Required minimum arc rating of PPE in Cal/cm squared.
 - 6. Available incident energy.
 - 7. Working distance.
 - 8. Engineering report number, revision number, and issue date.
- C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination study prior to starting the Arc-Flash Hazard Analysis.
 - 1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
 - 2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."
- C. Calculate maximum and minimum contributions of fault-current size.

1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
 2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
 3. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.
 4. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.
- D. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.
- E. Include medium- and low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.
- F. Calculate the limited, restricted, and prohibited approach boundaries for each location.
- G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
1. Fault contribution from induction motors shall not be considered beyond three to five cycles.
 2. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).
- H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:
1. When the circuit breaker is in a separate enclosure.
 2. When the line terminals of the circuit breaker are separate from the work location.
- I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the arc-flash hazard analysis.
1. Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.
 2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.

3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.
- B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 2. Obtain electrical power utility impedance or available short circuit current at the service.
 3. Power sources and ties.
 4. Short-circuit current at each system bus (three phase and line to ground).
 5. Full-load current of all loads.
 6. Voltage level at each bus.
 7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
 8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
 9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
 10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
 11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
 12. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
 13. Motor horsepower and NEMA MG 1 code letter designation.
 14. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
 15. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

3.4 LABELING

- A. Apply one arc-flash label on the front cover of each section of the equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.
- B. Each piece of equipment listed below shall have an arc-flash label applied to it:
 1. Motor-control center.
 2. Low-voltage switchboard.
 3. Switchgear.
 4. Medium-voltage switch.

5. Medium voltage transformers
6. Low voltage transformers. Exclude transformers with high voltage side 240 V or less and less than 125 kVA.
7. Panelboard and safety switch over 250 V.
8. Applicable panelboard and safety switch under 250 V.
9. Control panel.

C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.

1. Indicate arc-flash energy.
2. Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.6 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 260573.19

SECTION 260923 - LIGHTING CONTROL DEVICES

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. Indoor occupancy sensors.
 - 2. Switchbox-mounted occupancy sensors.
- B. Related Requirements:
 - 1. Section 262726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 INDOOR CEILING-MOUNTED OCCUPANCY SENSORS

- 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. Bryant Electric.
 - 2. Cooper Industries, Inc.
 - 3. Hubbell Building Automation, Inc.
 - 4. Leviton Manufacturing Co., Inc.
 - 5. Lightolier Controls.
 - 6. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - 7. Lutron Electronics Co., Inc.
 - 8. NSi Industries LLC; TORK Products.
 - 9. RAB Lighting.
 - 10. Sensor Switch, Inc.
 - 11. Square D.
 - 12. Watt Stopper.
 - 13. Or equal.

- B. General Requirements for Sensors: Ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
- C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
- D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.
1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch- high ceiling.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.
 5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot- high ceiling in a corridor not wider than 14 feet.
- E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.

2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

- F. Requirements for controls with wall dimmer switches in multi-circuit zone (i.e. FBO Terminal Waiting Room 110): Acuity nLight (or equivalent)
1. Low voltage dimmer switches (as opposed to line voltage) are required for control of lighting in zones with more than one circuit (two pole dimmer switches
 2. The nLight (or equivalent) power packs with integral 0-10V dimming output will control fixture dimming rather than the dimmer switch.
 3. A separate nLight (or equivalent) power pack is required for each circuit (two are required for FBO Terminal Waiting Room 110).

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- 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. Bryant Electric.
 2. Cooper Industries, Inc.
 3. Hubbell Building Automation, Inc.
 4. Leviton Manufacturing Co., Inc.
 5. Lightolier Controls.
 6. Lithonia Lighting; Acuity Brands Lighting, Inc.
 7. Lutron Electronics Co., Inc.
 8. NSi Industries LLC; TORK Products.
 9. RAB Lighting.
 10. Sensor Switch, Inc.
 11. Square D.
 12. Watt Stopper.
 13. Or equal.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
 3. Switch Rating: Not less than 1200-VA at 277V and 800-W at 120V.
- C. Wall-Switch Sensor:
1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area as required.
 2. Sensing Technology: Dual technology - PIR and ultrasonic.
 3. Switch Type: SP.
 4. Voltage: 120-277V; dual-technology type.

5. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
6. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.

2.3 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- C. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 260923

SECTION 261213 - LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes liquid-filled, medium-voltage substation transformers, with primary and secondary bushings within or without air-terminal enclosures.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For liquid-filled, medium-voltage transformers.
 - 1. Include plans and elevations showing major components and features.
 - a. Include a plan view and cross section of equipment base, showing clearances, manufacturer's recommended workspace, and locations of penetrations for grounding and conduits.
 - 2. Include details of equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include single-line diagram.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings for Outdoor Installations:
 - 1. Utilities site plan, drawn to scale, showing heavy equipment or truck access paths for maintenance and replacement.
- B. Coordination Drawings for Indoor Installations:
 - 1. Location plan, showing heavy equipment or truck access paths for maintenance and replacement.
 - 2. Dimensioned concrete base, outline of transformer, conduit entries, and grounding equipment locations.
- C. Seismic Qualification Certificates: For transformer assembly, accessories, and components, from manufacturer.
- D. Product certificates.
- E. Source quality-control reports.

F. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

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. Cooper Industries, Inc.
2. Eaton.
3. General Electric Company.
4. Siemens Industry, Inc., Energy Management Division.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2.

C. Comply with IEEE C57.12.00.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: The transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the transformer will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Component Importance Factor: 1.5.
3. Component Amplification Factor: 2.5.
4. Component Response Modification Factor: 6.0.

- B. Windings Material: Aluminum.
- C. Surge Arresters: Comply with IEEE C62.11, Distribution Class; metal-oxide-varistor type, connected in each phase of incoming circuit and ahead of any disconnecting device.
- D. Winding Connections: The connection of windings and terminal markings shall comply with IEEE C57.12.70.
- E. Insulation:
 - 1. Transformer kVA Rating, when Indicated at 65 deg C Rise, Shall Be as Follows: The average winding temperature rise above ambient temperature shall not exceed 65 deg C and 80 deg C hottest-spot temperature rise at rated kVA when tested according to IEEE C57.12.90, using combination of connections and taps that give the highest average winding temperature rise.
- F. Bushings shall comply with IEEE C57.19.01 requirements for impulse and low-frequency insulation levels.
- G. Tap Changer: External, for de-energized operation.
- H. Mounting: An integral skid mounting frame, suitable to allow skidding or rolling of transformer in any direction, and with provision for anchoring frame to pad.
- I. Insulating Liquids:
 - 1. Mineral Oil: ASTM D 3487, Type II, and tested for compliance with ASTM D 117.
- J. Capacities and Characteristics:
 - 1. Location: Outdoors.
 - 2. Additional IEEE Standards: Comply with IEEE C57.12.10.
 - 3. Altitude: 732'.
 - 4. Connections:
 - a. Primary: Air-filled terminal cabinet for cable connection.
 - b. Secondary: Air-filled terminal cabinet for cable connection.
 - 5. Transformer Ratings. Comply with IEEE C57.12.00 for cooling class.
 - a. Self-Cooled Rating, Class ONAN: 250 kVA.
 - 1) Self-Cooled: 250 kVA.
 - 2) Make provision for future addition of forced-air-cooling equipment. The transformer bushings, leads, and related components shall be sized for the future equipment. Provide fan mounts, conduit supports, and terminal boxes.
 - b. Impedance: Not less than 5.75 percent.
 - c. Temperature Rise: 65 deg C.

- d. Coils Connection:
 - 1) High-Voltage Winding: Delta.
 - 2) Low-Voltage Winding: Wye.
- e. Voltage and BIL Ratings:
 - 1) Nominal primary phase-to-phase voltage and BIL: 4160 V, 60 kV.
 - 2) Nominal secondary voltage and BIL: 480Y/277 V, 45 kV.
- 6. Outdoor Transformer Enclosure Finish: Factory-applied finish in manufacturer's standard color, corrosion resistance complying with IEEE C57.12.28.
- 7. Indoor Transformer Enclosure Finish: Factory-applied finish in manufacturer's standard gray over a rust-inhibiting primer on treated metal surface.
- 8. Special Corrosion-Resistant Enclosure Finish: Factory-applied, corrosion-resistant finish in manufacturer's standard color that withstands 480 hours of exposure to salt-spray test specified in ASTM B 117 without loss of paint or release of adhesion of paint primer coat to metal surface in excess of 1/16 inch from test mark. Scribed test mark and test evaluation shall be according to ASTM D 1654 with a rating of not less than 7 according to Table 1 (Procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel, or mill-galvanized sheet steel shall be coated with a manufacturer's standard zinc-rich paint.
- 9. Taps: Two 2-1/2-percent, full-capacity taps above, and two 2-1/2-percent, full-capacity taps below rated voltage. Comply with IEEE C57.12.36 requirements.
- 10. Transformer Accessories:
 - a. Drain and filter connection.
 - b. Filling and top filter press connections.
 - c. Pressure-vacuum gauge.
 - d. Dial-type analog thermometer with alarm contacts.
 - e. Magnetic liquid level indicator with high and low alarm contacts.
 - f. Pressure-relief device set to operate at 10 psig, plus or minus 2 psig, and then automatically reseal when pressure drops to 6-psig minimum. Device flow shall be as recommended by manufacturer. With alarm contacts and a manual bleeder.
 - g. At least four stainless-steel ground connection pads.
 - h. Provisions for jacking, lifting, and towing.
 - i. Machine-engraved nameplate made of anodized aluminum or stainless steel.
 - j. Sudden pressure relay for remote alarm or trip when internal transformer pressure rises at field-set rate. Provide with seal-in delay.

2.4 CONTROL NETWORK

- A. Controllers: Support serial MS/TP and Ethernet IP communications, and able to communicate directly via RS-485 serial networks and Ethernet 10Base-T networks as a native device.

2.5 WARNING LABELS AND SIGNS

- A. Comply with requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."
 - 1. Warning signs shall be made of baked enamel.
 - 2. Equipment Identification Labels: Engraved, laminated-acrylic or -melamine label.

2.6 SOURCE QUALITY CONTROL

- A. Provide manufacturer's certificate verifying the transformer design tests comply with IEEE C57.12.90.
- B. Perform the following factory-certified routine tests on each transformer for this Project:
 - 1. Resistance.
 - 2. Turns ratio, polarity, and phase relation.
 - 3. Transformer no-load losses and excitation current at 100 percent of ratings.
 - 4. Transformer impedance voltage and load loss.
 - 5. Operation of all devices.
 - 6. Control (auxiliary) and consumption losses.
 - 7. Lightning impulse.
 - 8. Low frequency.
 - 9. Leak test.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Handling:
 - 1. Handle transformers carefully. Do not subject transformers to impact, jolting, jarring, or rough handling.
 - 2. Protect transformer termination compartments against entrance of dust, rain, and snow.
 - 3. Transport transformers upright.
- B. Examine areas and space conditions for compliance with requirements for liquid-filled, medium-voltage transformers and other conditions affecting performance of the Work.
- C. Examine roughing-in of conduits and grounding systems to verify the following:
 - 1. Wiring entries comply with layout requirements.
 - 2. Entries are within conduit-entry tolerances specified by manufacturer, and no feeders will cross section barriers to reach load or line lugs.
- D. Verify that ground connections are in place and that requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at transformer location.

- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install transformers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
- B. Transformer shall be installed level and plumb and shall tilt less than 1.5 degrees while energized.
- C. Comply with requirements for vibration isolation and seismic control devices specified in Section 260529 "Hangers and Supports for Electrical Systems" and Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

3.3 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. At Interior Locations: For grounding to grounding electrodes, use bare copper cable not smaller than No. 4/0 AWG. Bond surge arrester and neutrals directly to transformer enclosure and then to grounding electrode system with bare copper conductors. Keep leads as short as practicable, with no kinks or sharp bends. Make joints in grounding conductors and loops by exothermic weld or compression connector.
 - 2. At Exterior Locations:
 - a. For counterpoise, use tinned bare copper cable not smaller than No. 4/0 AWG, buried not less than 30 inches (765 mm) below grade interconnecting grounding electrodes. Bond surge arrester and neutrals directly to transformer enclosure and then to grounding electrode system with bare copper conductors. Keep lead lengths as short as practicable, with no kinks or sharp bends.
 - b. Fence and equipment connections shall not be smaller than No. 4 AWG. Ground fence at each gate post and corner post and at intervals not exceeding 10 ft. (3050 mm.) Bond each gate section to fence post using 1/8 by 1 inch (3 by 25 mm) flexible braided copper strap and clamps.
 - c. Make joints in grounding conductors and loops by exothermic weld or compression connector.
 - 3. Terminate all grounding and bonding conductors on a common equipment grounding terminal on transformer enclosure. Install supplemental terminal bars, lugs, and bonding jumpers as required to accommodate number of conductors for termination.
 - 4. Complete transformer tank grounding and lightning arrester connections prior to making any other electrical connections.

- B. Terminate medium-voltage cables in incoming section of substations according to Section 260513 "Medium-Voltage Cables."

3.4 SIGNS AND LABELS

- A. Comply with installation requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."
- B. Install warning signs as required to comply with 29 CFR 1910.269.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. General Field-Testing Requirements:
 - a. Comply with provisions of NFPA 70B, Ch. "Testing and Test Methods."
 - b. After installing transformer but before primary is energized, verify that grounding system at substation is tested at specified value or less.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION 261213

SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
 - 3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Data: Certificates, for transformers, accessories, and components, from manufacturer.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

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. Acme Electric Corporation.
 2. Controlled Power Company; an Emerson company.
 3. Dongan Electric Manufacturing Company.
 4. Eaton.
 5. Federal Pacific.
 6. General Electric Company.
 7. Hammond Power Solutions Inc.
 8. Lincoln Electric Products Co., Inc.
 9. Siemens Industry, Inc., Energy Management Division.
 10. Square D; by Schneider Electric.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the transformer will remain in place without separation of any parts when subjected to the seismic forces specified and the transformer will be fully operational after the seismic event."

2.3 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Comply with NFPA 70.
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Transformers Rated 15 kVA and Larger:
1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
 2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.
- D. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.
- E. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
- F. Coils: Continuous windings without splices except for taps.

1. Coil Material: Aluminum.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Bolted.

G. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.4 DISTRIBUTION TRANSFORMERS

- A. Comply with NFPA 70, and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Cores: One leg per phase.
- D. Enclosure: Ventilated.
1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound using a vacuum-pressure impregnation process to seal out moisture and air.
 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
 3. Wiring Compartment: Sized for conduit entry and wiring installation.
- E. Enclosure: Ventilated.
1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
 2. Wiring Compartment: Sized for conduit entry and wiring installation.
- F. Taps for Transformers 3 kVA and Smaller: None.
- G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- I. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- J. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- K. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.
- L. Wall Brackets: Manufacturer's standard brackets.

2.5 IDENTIFICATION

- A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."
- B. Nameplates: Self-adhesive label for each distribution transformer. Self-adhesive labels are specified in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

3.2 INSTALLATION

- A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - 1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.
- B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.
- C. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 260529 "Hangers and Supports for Electrical Systems."
 - 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

- D. Secure transformer to concrete base according to manufacturer's written instructions.
- E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.
- F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. 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-486B.
- D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
- D. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:
 - 1. Visual and Mechanical Inspection.
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, and grounding.
 - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - d. Verify the unit is clean.
 - e. Perform specific inspections and mechanical tests recommended by manufacturer.
 - f. Verify that as-left tap connections are as specified.
 - g. Verify the presence of surge arresters and that their ratings are as specified.
 - 2. Electrical Tests:
 - a. Measure resistance at each winding, tap, and bolted connection.
 - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence

of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.

- c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
 - d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- E. Remove and replace units that do not pass tests or inspections and retest as specified above.
- F. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262213

SECTION 262416 - PANELBOARDS

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. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.

1.5 INFORMATIONAL SUBMITTALS

- A. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than one week in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service without Construction Manager's written permission.
 - 3. Comply with NFPA 70E.

1.9 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Surface-mounted cabinet.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
- B. Incoming Mains Location: Top.
- C. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main Lugs: Compression type.
 - 3. Neutral Lugs: Mechanical type.
 - 4. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- E. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- 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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
 - 5. Or equal.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker.

- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- 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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
 - 5. Or equal.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Electronic trip circuit breakers for main breaker, with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Adjustable Instantaneous trip.
 - b. Adjustable short-time pickup and delay.
 - 3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install overcurrent protective devices and controllers not already factory installed.
- G. Install filler plates in unused spaces.
- H. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 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.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Weather-resistant receptacles.
 - 3. Snap switches and wall-box dimmers.
 - 4. Wall-switch and exterior occupancy sensors.
 - 5. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand (Pass & Seymour).
 - 5. Or Equal.

- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Comply with NFPA 70.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 5351 (single), CR5362 (duplex).
 - b. Hubbell; HBL5351 (single), HBL5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5361 (single), 5362 (duplex).
 - e. Or equal.

2.4 GFCI RECEPTACLES

- A. General Description:
 - 1. Straight blade, non-feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; VGF20.
 - b. Hubbell; GFR5352L.
 - c. Pass & Seymour; 2095.
 - d. Leviton; 7590.
 - e. Or equal.

2.5 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Single Pole:
 - 1) Cooper; AH1221.
 - 2) Hubbell; HBL1221.
 - 3) Leviton; 1221-2.
 - 4) Pass & Seymour; CSB20AC1.
 - 5) Or equal.
 - b. Double Pole:
 - 1) Cooper; AH1222
 - 2) Hubbell; 1222
 - c. Three Way:
 - 1) Cooper; AH1223.
 - 2) Hubbell; HBL1223.
 - 3) Leviton; 1223-2.
 - 4) Pass & Seymour; CSB20AC3.
 - 5) Or equal.

2.6 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Operation: 0-10VC control for LED fixtures.

2.7 WALL PLATES

- A. Single and combination types shall 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.
 - 3. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof While in Use Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable cover.

2.8 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, with satin finish.
- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, where indicated.
- E. Voice and Data Communication Outlet: Where indicated.
- F. Furniture feed applications: Service plate with $\frac{3}{4}$ - inch opening for power and 1 $\frac{1}{4}$ - inch opening for communications, where indicated.

2.9 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: Ivory unless otherwise indicated or required by NFPA 70 or device listing.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right .

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.

2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Test Instruments: Use instruments that comply with UL 1436.
 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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:
 - 1. Nonfusible switches.
 - 2. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Construction Manager's written permission.
 - 4. Comply with NFPA 70E.

1.8 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 NONFUSIBLE SWITCHES

- 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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
 - 5. Or equal.

- B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Lugs: Compression type, suitable for number, size, and conductor material.

2.2 ENCLOSURES

- A. Enclosed Switches: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 264113 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes lightning protection system for the following:
 - 1. Ordinary structures.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include layouts of the lightning protection system, with details of the components to be used in the installation.
 - 2. Include raceway locations needed for the installation of conductors.
 - 3. Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.
 - 4. Calculations required by NFPA 780 for bonding of metal bodies.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Lightning protection system Shop Drawings, drawn to scale, coordinated with each other, using input from installers of the items involved:
- B. Qualification Data: For Installer.
- C. Product certificates.
- D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Completion Certificate:
 - 1. UL Master Label Certificate.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: UL-listed installer, category OWAY.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. <u>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. Advanced Lightning Technology, Ltd.
 - 2. East Coast Lightning Equipment Inc.
 - 3. ERICO International Corporation.
 - 4. Harger Lightning & Grounding.
 - 5. Heary Bros. Lightning Protection Co. Inc.
 - 6. Independent Protection Co.
 - 7. National Lightning Protection.
 - 8. Preferred Lightning Protection.
 - 9. Robbins Lightning, Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. NFPA Lightning Protection Standard: Comply with NFPA 780 requirements for [Class I] [Class II] buildings.
- B. UL Lightning Protection Standard: Comply with UL 96A requirements for [Class I] [Class II] buildings.
- C. Lightning Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency as complying with UL 96, and marked for intended location and application.

2.3 MATERIALS

- A. Air Terminals:
 - 1. Copper or Aluminum unless otherwise indicated.
 - 2. 3/8-inch (10-mm) diameter by 15 inches (380 mm) long.
 - 3. Rounded tip.
 - 4. Integral base support.
- B. Class I Main Conductors:
 - 1. Stranded Copper: 57,400 circular mils in diameter.
 - 2. Aluminum: 98,600 circular mils in diameter.
- C. Class II Main Conductors:

1. Stranded Copper: 115,000 circular mils in diameter.
 2. Aluminum: 192,000 circular mils in diameter.
- D. Secondary Conductors:
1. Stranded Copper: 26,240 circular mils in diameter.
 2. Aluminum: 41,400 circular mils in diameter.
- E. Ground Loop Conductor: Stranded copper.
- F. Ground Rods:
1. Material: Solid copper.
 2. Diameter: 5/8 inch (16 mm).
 3. Rods shall be not less than 120 inches (3050 mm) long.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lightning protection components and systems according to NFPA 780.
- B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches (203 mm) in radius and narrow loops.
- C. Conceal conductors within normal view from exterior locations at grade within 200 feet (60 m) of building. Comply with requirements for concealed systems in NFPA 780.
- D. Ground Ring Electrode: The conductor shall be not less than the main-size lightning conductor.

3.2 CONNECTIONS

- A. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.
- B. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: exothermic weld.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Perform inspections as required to obtain a UL Master Label for system.
 - 2. Perform inspections to obtain an LPI certification.

- B. Prepare test and inspection reports and certificates.

END OF SECTION 264113

SECTION 265119 - LED INTERIOR LIGHTING

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 the following types of LED luminaires:
 - 1. Suspended, 2 x 2.
 - 2. Strip light.
 - 3. Surface mount, linear.
 - 4. Suspended, linear.
 - 5. Suspended, non-linear.
 - 6. Exit Signs
- B. Related Requirements:
 - 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.

B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of luminaire.

B. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Ambient Temperature: 41 to 104 deg F (5 to 40 deg C).
 - 1. Relative Humidity: Zero to 95 percent.

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI.
- C. Recessed luminaires shall comply with NEMA LE 4.
- D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

2.3 FIXTURE REQUIREMENTS

- A. Nominal Operating Voltage: 277 V ac.
- B. Lamp:
 - 1. Minimum allowable efficacy of 80 lm/W.
 - 2. CRI of 70. CCT of 5000 K.
 - 3. Rated lamp life of 100,000 hours to L70.
 - 4. Dimmable from 100 percent to 0 percent of maximum light output.
 - 5. Internal driver.
 - 6. User-Replaceable Lamps:
 - a. Bulb shape complying with ANSI C78.79.
 - b. Lamp base complying with ANSI C81.61.
 - 7. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum housing and heat sink.
2. Clear finish.
3. Universal mounting bracket.
4. Integral junction box with conduit fittings.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Fixed lens.
2. Light distribution- see drawings.
3. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
4. Glass: Annealed crystal glass unless otherwise indicated.
5. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

F. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. Recessed luminaires shall comply with NEMA LE 4.

2.4 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type rated for 90 minutes backup capability.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

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. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaires:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaires:
 - 1. Attached using through bolts and backing plates on either side of wall
 - 2. Do not attach luminaires directly to gypsum board.
- G. Suspended Luminaires:
 - 1. Ceiling Mount:
 - a. Two 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 5 ft.
 - 2. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.

4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265119

SECTION 265213 - EMERGENCY AND EXIT LIGHTING

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. Emergency lighting units.
 - 2. Exit signs.
 - 3. Luminaire supports.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.
 - 1. Include data on features, accessories, and finishes.
 - 2. Include physical description of the unit and dimensions.
 - 3. Battery and charger for light units.
 - 4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
 - 5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.

- a. Testing Agency Certified Data: For indicated luminaires and signs, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires and signs shall be certified by manufacturer.
 - b. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Shop Drawings: For nonstandard or custom luminaires.
- 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Sustainable Design Submittals:
- 1. Product Data: Indicating luminaire is certified by ENERGY STAR.
 - 2. Product Data: For lamps, indicating mercury content and lamp life.
- D. Samples: For each product and for each color and texture specified.
- E. Samples for Initial Selection: For each type of luminaire with factory-applied finishes.
- F. Samples for Verification: For each type of luminaire.
- 1. Include Samples of luminaires and accessories to verify finish selection.
- G. Product Schedule:
- 1. For emergency lighting units. Use same designations indicated on Drawings.
 - 2. For exit signs. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
- 1. Luminaires.
 - 2. Suspended ceiling components.
 - 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
 - 4. Structural members to which equipment will be attached.
 - 5. Size and location of initial access modules for acoustical tile.
 - 6. Items penetrating finished ceiling including the following:
 - a. Other luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.

- d. Ceiling-mounted projectors.
 - e. Sprinklers.
 - f. Access panels.
 - 7. Moldings.
 - B. Qualification Data: For testing laboratory providing photometric data for luminaires.
 - C. Product Certificates: For each type of luminaire.
 - D. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - 4. Provide seismic qualification certificate for each piece of equipment.
 - E. Product Test Reports: For each luminaire for tests performed by manufacturer and witnessed by a qualified testing agency.
 - F. Sample Warranty: For manufacturer's warranty.
- 1.6 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.
- 1.7 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Luminaire-mounted, emergency battery pack: One for every 10 emergency lighting units. Furnish at least one of each type.
 - 3. Diffusers and Lenses: 1 of each type and rating installed. Furnish at least one of each type.
 - 4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.
 - 1. Obtain Architect's approval of luminaires and signs in mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two year(s) from date of Substantial Completion.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Power Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.
 - 2. Warranty Period for Self-Powered Exit Sign Batteries: Five years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

2.2 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for fluorescent luminaires.
- F. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.
- G. Bulb Shape: Complying with ANSI C79.1.
- H. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.
 - 1. Emergency Connection: Operate one lamp(s) continuously at an output of designed lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
 - 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
 - c. Humidity: More than 95 percent (condensing).
 - d. Altitude: Exceeding 3300 feet (1000 m).

4. Nightlight Connection: Operate lamp continuously at percent of rated light output.
 5. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 6. Battery: Sealed, maintenance-free, nickel-cadmium type.
 7. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 8. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
- I. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from luminaire.
1. Emergency Connection: Operate one LED lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire.
 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 3. Nightlight Connection: Operate lamp in a remote luminaire continuously.
 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type.
 6. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the emergency power unit manufacturer, whichever is less.
 7. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 8. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 9. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 10. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.3 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:

1. 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:

- a. Amerlux.
- b. Cooper Lighting, an Eaton business.
- c. Dual-Lite.
- d. GE Lighting Solutions.
- e. Juno Lighting Group by Schneider Electric.
- f. Lightolier; a Philips group brand.
- g. Lithonia Lighting; Acuity Brands Lighting, Inc.

2. Emergency Luminaires: EI series drawing as indicated on Lighting Fixture Schedule, with the following additional features:

- a. Operating at nominal voltage of 277 V ac.
- b. External emergency power unit.
- c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.
- d. UL 94 5VA flame rating.

C. Emergency Lighting Unit:

1. 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:

- a. Amerlux.
- b. Cooper Lighting, an Eaton business.
- c. Dual-Lite.
- d. Evenlite, Inc.
- e. GE Lighting Solutions.
- f. Lighting Services, Inc.
- g. Lithonia Lighting; Acuity Brands Lighting, Inc.

2. Emergency Lighting Unit: EL series drawings as indicated on Lighting Fixture Schedule.

3. Operating at nominal voltage of 277 V ac.

4. Wall with universal junction box adaptor.

5. UV stable thermoplastic housing.

6. Two LED lamp heads.

7. Internal emergency power unit.

D. Remote Emergency Lighting Units:

1. 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:
 - a. Cooper Lighting, an Eaton business.
 - b. GE Lighting Solutions.
 - c. Hubbell Industrial Lighting; Hubbell Incorporated.
 - d. Juno Lighting Group by Schneider Electric.
 - e. Lithonia Lighting; Acuity Brands Lighting, Inc.
2. Emergency Lighting Unit: E1 series drawings as indicated on Lighting Fixture Schedule.
3. Operating at nominal voltage of 277 V ac.
4. Wall with universal junction box adaptor.
5. UV stable thermoplastic housing.
6. LED lamp heads.
7. External emergency power unit.

2.4 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 1. 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:
 - a. Amerlux.
 - b. Cooper Lighting, an Eaton business.
 - c. Evenlite, Inc.
 - d. Hubbell Industrial Lighting; Hubbell Incorporated.
 - e. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - f. Philips Lighting Company.
 2. Operating at nominal voltage of 277 V ac.
 3. Lamps for AC Operation: Fluorescent, two for each luminaire; 20,000 hours of rated lamp life.
 4. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
 5. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.
 6. Master/Remote Sign Configurations:
 - a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
 - b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power

requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.5 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Clear, UV-stabilized acrylic.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
4. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Housings:

1. Extruded aluminum housing and heat sink.
2. Clear painted finish.

E. Conduit: Electrical metallic tubing, minimum 3/4 inch (21 mm) in diameter.

2.6 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire and emergency power unit weight.
 - 2. Able to maintain luminaire position when testing emergency power unit.
 - 3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.
- E. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
 - 2. Do not attach luminaires directly to gypsum board.
- F. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
 - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

- C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

- A. Perform startup service:

1. Charge emergency power units and batteries minimum of one hour and depress switch to conduct short-duration test.
2. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

- A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.
 - a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 265213

SECTION 265619 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 260926 "Lighting Control Panelboards" for panelboard-based lighting control.
3. Section 260943.16 "Addressable-Luminaire Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
4. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
- B. Shop Drawings: For nonstandard or custom luminaires.
 1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Sustainable Design Submittals:

1. Product Data: BUG ratings.
2. Product Data: Luminaire calculations.
3. Product Data: Indicating luminaire is certified by ENERGY STAR.

D. Delegated-Design Submittal: For luminaire supports.

1. Include design calculations for luminaire supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale and coordinated.

B. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.

C. Product Certificates: For each type of the following:

1. Luminaire.
2. Photoelectric relay.

D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.6 FIELD CONDITIONS

A. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.7 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. Lamp base complying with ANSI C81.61 or IEC 60061-1.
- F. CRI of minimum 80. CCT of 4000K.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Nominal Operating Voltage: 277 V ac.
- I. In-line Fusing: On the primary for each luminaire.
- J. Lamp Rating: Lamp marked for outdoor use.
- K. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- L. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE TYPES

- A. Area and Site:

1. 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:
 - a. Atlas Lighting Products.
 - b. Cooper Lighting, an Eaton business.
 - c. Gallium Lighting, LLC.
 - d. GE Lighting Solutions.
 - e. H.E. Williams.
 - f. Juno Lighting Group by Schneider Electric.
 - g. Lightolier; a Philips group brand.
 - h. Lithonia Lighting; Acuity Brands Lighting, Inc.
2. Luminaire Shape: Square.
3. Mounting: Building with extruded-aluminum stainless-steel round arm, 11 inches (280 mm) in length.
4. Luminaire-Mounting Height: reference E-600 Lighting Fixture Schedule.
5. Distribution: As Designed.

2.4 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Corrosion-resistant aluminum Stainless steel. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- D. Diffusers and Globes:
 1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 2. Glass: Annealed crystal glass unless otherwise indicated.
 3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 1. White Surfaces: 85 percent.
 2. Specular Surfaces: 83 percent.
 3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

2.5 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
 - a. Color: Black.

D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.
 - b. Color: Match Architect's sample of manufacturer's standard color.
 - c. Color: As selected by Architect from manufacturer's full range.

2.6 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Support luminaires without causing deflection of finished surface.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to a minimum 1/8 inch (3 mm) backing plate attached to wall structural members.
- G. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.
- I. Coordinate layout and installation of luminaires with other construction.
- J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.2 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

- A. Aim as indicated on Drawings.

- B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.3 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
 - a. IES LM-5.
 - b. IES LM-50.
 - c. IES LM-52.
 - d. IES LM-64.
 - e. IES LM-72.
 - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

END OF SECTION 265619

SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Notification appliances.
6. Remote annunciator.
7. Addressable interface device.
8. Digital alarm communicator transmitter.

1.2 ACTION SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified, fire-alarm technician; Level III or Level IV minimum.
 - c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product, including furnished options and accessories.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.

10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring required for HVAC unit shutdown on alarm.
 - c. Locate detectors according to manufacturer's written recommendations.
 12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.
- D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
 3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
 1. Include the following and deliver copies to authorities having jurisdiction:
 - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between all devices and equipment.
 - d. Riser diagram.
 - e. Record copy of site-specific software.

- f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.
 - 3) Frequency of inspection of installed components.
 - 4) Requirements and recommendations related to results of maintenance.
 - 5) Manufacturer's user training manuals.
- g. Manufacturer's required maintenance related to system warranty requirements.
- h. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

- 1. Software operating and upgrade manuals.
- 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
- 3. Device address list.
- 4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II, Level III or Level IV technician.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Noncoded, UL-certified or FM Global-placarded addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- C. Automatic sensitivity control of certain smoke detectors.
- D. All components provided shall be listed for use with the selected system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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. Smoke detectors.
3. Fire-extinguishing system operation.
4. Dry system pressure flow switch.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
5. Close smoke dampers in air ducts of designated air-conditioning duct systems.
6. Activate dry pipe sprinkler system alarm.
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. High- or low-air-pressure switch of a dry-pipe sprinkler system.
3. Loss of communication with any panel on the network.

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 communication with any addressable sensor, input module, relay, control module, or remote annunciator.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
3. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class B.
2. Pathway Survivability: Level 0.

D. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

E. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.

F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals, supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38.
1. Double-action mechanism, or pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 2. Station Reset: Key- or wrench-operated switch.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
1. Comply with UL 268; operating at 24-V dc, nominal.
 2. Detectors shall be four or two-wire type.
 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 7. Remote Control: Unless otherwise indicated, detectors shall be digital-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.
 - a. Multiple levels of detection sensitivity for each sensor.
 - b. Sensitivity levels based on time of day.
- B. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

2.6 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464.
- C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
 - 1. Mounting: Wall mounted unless otherwise indicated.
 - 2. Flashing shall be in a temporal pattern, synchronized with other units.
 - 3. Strobe Leads: Factory connected to screw terminals.
 - 4. Mounting Faceplate: Factory finished, red or white.

2.7 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - 1. Mounting: Surface cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.8 ADDRESSABLE INTERFACE DEVICE

- A. General:
 - 1. Include address-setting means on the module.
 - 2. Store an internal identifying code for control panel use to identify the module type.
 - 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Control Module:
 - 1. Operate notification devices.
 - 2. Operate solenoids for use in sprinkler service.

2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically dial a preset number for a remote central station through a fiber optic cable. 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 fiber optic line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report fiber optic service restoration to the central station. If service is lost on fiber optic line, 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 fiber optic line is 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 of the trouble-initiating device.
 - 4. Loss of ac supply.
 - 5. Loss of power.
 - 6. Low battery.
 - 7. Abnormal test signal.
 - 8. 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.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

- C. Equipment Mounting: Install fire-alarm control unit on finished floor.
- D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
- E. Manual Fire-Alarm Boxes:
 - 1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
 - 2. Mount manual fire-alarm box on a background of a contrasting color.
 - 3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- F. Smoke- or Heat-Detector Spacing: Comply with NFPA 72.
- G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.
- H. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- I. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.
- K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 PATHWAYS

- A. Pathways shall be installed in EMT.
- B. Exposed EMT shall be painted red enamel.

3.3 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 Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an

addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated HVAC duct systems.
2. Alarm-initiating connection to activate emergency lighting control.
3. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
4. Supervisory connections at valve supervisory switches.
5. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals.
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 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.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.6 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by Architect or authorities having jurisdiction.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72

and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

- C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 284621.11

SECTION 310516 - AGGREGATE MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Aggregate materials for use as gravel driveways, roadways, parking lots, erosion control measures and other project requirements.
- B. Provisions of the Contract Documents, including requirements of Division 1, apply to the work of this Section.
 - 1. Section 31 20 00 – Earth Moving
 - 2. Section 31 25 13 - Erosion and Sedimentation Control

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM) latest edition.
 - 1. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ANSI/ASTM D698 - Test Method for Compaction Characteristics of Soils, Using Standard Effort (Standard Proctor).
 - 3. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 4. ASTM D2487 - Classification of Soils for Engineering Purposes.
 - 5. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 6. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
 - 7. ASTM D4318 - Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- B. American Association of State Highway and Transportation Officials (AASHTO) latest edition.
 - 1. AASHTO M147 - Materials for Aggregate and Soil-Aggregate.
- C. Pennsylvania Department of Transportation (PADOT)
 - 1. Publication 408 - Specifications
 - 2. Publication 34 - Aggregate Producers (Bulletin 14)

1.3 QUALITY ASSURANCE

- A. Tests and analysis of aggregate material will be performed in accordance with standard ASTM and AASHTO procedures listed herein.

1.4 SUBMITTALS

- A. Comply with Division 1 requirements for submittals.
- B. Submit the name of each material supplier and specific type and source of each material. Changes in source throughout the job require approval of the Owner's Representative.
- C. Submit materials certificate signed by material producer and Contractor, certifying that materials comply with requirements of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. PADOT No. 2A Limestone
 - 1. Suppliers shall be listed in PADOT Bulletin 14.
 - 2. Construction and materials shall comply with Sections 850 and 703, PADOT Publication 408.

- B. AASHTO No. 57 Gradation Crushed Stone
 - 1. Suppliers shall be listed in PADOT Bulletin 14.
 - 2. Construction and materials shall comply with Section 703, PADOT Publication 408.

PART 3 - EXECUTION

3.1 STOCKPILING

- A. Stockpile onsite at locations indicated by the Owner's Representative in such a manner that there will be no standing water or mixing with other materials.

3.2 TRANSPORTATION

- A. Offsite materials shall be transported to the project using well maintained and operating vehicles. Once on the job site, transporting vehicles shall stay on designated roads.

END OF SECTION

SECTION 31 05 19 - GEOTEXTILES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Provide and install geotextile fabrics for the class specified.
- B. Provisions of the Contract Documents, including requirements of Division 1, apply to the work of this Section.
 - 1. Section 31 20 00 – Earth Moving
 - 2. Section 31 25 13 - Erosion and Sedimentation Control
 - 3. Section 33 40 00 - Storm Sewer System

1.2 REFERENCES

- A. Pennsylvania Department of Transportation (PADOT):
 - 1. Publication 408 - Specifications
 - 2. Publication 72 - Standards for Roadway Construction
- B. American Society for Testing and Materials (ASTM)

1.3 SUBMITTALS

- A. Comply with Division 1 requirements for submittals.
- B. Submit materials certificate signed by material supplier and Contractor, certifying that materials comply with, or exceed, the requirements of this Section.

PART 2 - PRODUCTS

2.1 GEOTEXTILE MATERIAL

- A. Comply with Section 735, PADOT Publication 408.
 - 1. Subsurface Drainage - Class 1
 - 2. Erosion Control - Class 2, Type A or Type B
 - 3. Sediment Control - Class 3, Type A or Type B
 - 4. Separation - Class 4

PART 3 - EXECUTION

3.1 GENERAL

- A. Remove and replace fabric areas damaged during construction. Lap or sew replaced fabric, as specified for the class of fabric used. No traffic or construction equipment is permitted on the fabric.

3.2 CLASS 1 - SUBSURFACE DRAINAGE

- A. Install in accordance with Section 212.3(b), PADOT Publication 408.

3.03 CLASS 2 - EROSION CONTROL

- A. Install in accordance with Section 212.3(c), PADOT Publication 408.

3.4 CLASS 3 - SEDIMENTATION CONTROL

- A. Install in accordance with Section 865.3, PADOT Publication 408.

3.5 CLASS 4 -LAYER SEPARATION

- A. Install in accordance with Section 212.3(e), PADOT Publication 408.

END OF SECTION

SECTION 312000 - EARTH MOVING

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. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade and pavements.
3. Excavating and backfilling for buildings and structures.
4. Subbase course for asphalt paving.
5. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.3 DEFINITIONS

- A. Backfill: Soil material or aggregate used to fill an excavation.
- B. Bedding: Aggregate backfill placed over the excavated subgrade, around sides and to a height of 12 inches over the pipe or conduit and compacted to 95 percent of maximum dry density, according to ASTM D698..
- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- E. Fill: Soil materials used to raise existing grades.
- F. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

- G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- H. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete walk.
- I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- J. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Geotextiles.
 - 2. Warning tapes.
- B. Qualification Data: For qualified testing agency.
- C. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D 2487.
 - 2. Laboratory compaction curve according to ASTM D 698.
- D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.5 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.6 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

- B. Utility Locator Service: Notify Pennsylvania One Call System, Inc. (Pennsylvania 811) for area where Project is located before beginning earth-moving operations.
- C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 312513 "Erosion and Sedimentation Control" and on the Drawings are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Subbase Material: Shall meet the requirements of PennDOT 408, Section 03 for 2A coarse aggregate..
- B. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter equal to CL, ML, SM, SC, GM, GP, or GC in accordance with ASTM D2487, with a Plasticity Index less than 20.
- C. Imported Structural Fill: Imported structural shall comply with PennDOT 408, Section 703 for 2A coarse aggregate. Imported structural fill shall be used under foundations, footings, building slabs, exterior concrete and asphalt paving, and to replace unacceptable existing soil.
- D. Top Soil: All stockpiled top soil shall be used for lawn areas. In the event there is a shortage of stockpiled top soil the Contractor shall import top soil at his expense.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Survivability: As follows:
 - a. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
 - b. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
 - c. Tear Strength: 56 lbf (250 N); ASTM D 4533.
 - d. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
 - 3. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
 - 4. Permittivity: 0.5 per second, minimum; ASTM D 4491.
 - 5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Complying with Section 735 - Geotextiles of PennDOT Publication 408, Specifications, latest edition.

2.3 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil

materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations as shown on the Drawings or as recommended by the manufacturer of the pipe to be installed. Trenches shall allow for installation of top of pipe below frost line. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Provide vertical trench walls as shown on the Drawings where no manufacturer's printed installation manual is available. Shore trench walls more than 4 feet high or cut back walls of trench to at least the angle of repose of the soil. Give special attention to slopes which may be adversely affected by weather or moisture content.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
 1. Clearance: 12 inches (300 mm) each side of pipe or conduit or as indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches (150 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
- D. Removal of Unstable Material: Where unstable material is encountered in the bottom of the trench, remove such material to a minimum of 1 foot below subgrade or as directed by the Engineer. Replace unstable material with PennDOT 408, Section 703 for 2A coarse aggregate and compact to 95 percent and compact to 95 percent maximum dry density, according to ASTM D698. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost.

3.8 UBGRADE INSPECTION

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade until it does not rut under a loaded triaxle weighing a minimum of 75,000 lbs.
 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Engineer.
 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place soil material in layers to required subgrade elevations, for each area classification listed below, using excavated materials specified in Part 2 of this Section. In the event there is a shortage of excavated materials for backfilling, filling and grading, the Contractor shall import fill materials at his expense with materials specified in Part 2 of this Section except that fill under building slabs and foundations shall be imported structural fill as hereinafter specified.
 - 1. Fill under building footprint, exterior concrete, and asphalt paving shall be imported structural fill and shall comply with PennDOT 408, Section 703 for 2A coarse aggregate.
 - 2. Under grassed areas, use satisfactory excavated or borrow material up to the underside of the top soil.
 - 3. Under pavements, use fill material up to the underside of the subbase material.
- B. Place backfill on subgrades free of mud, frost, snow, or ice. Backfill excavations as promptly as work permits, but not until completion of adjoining related work.

3.12 UTILITY TRENCH BACKFILL

- A. Place bedding and backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings as shown on the Drawings and as recommended by the pipe manufacturer; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
- D. Backfill voids with satisfactory soil while removing shoring and bracing.
- E. Bedding:
 - 1. AASHTO No. 8 Coarse Aggregate: Backfill: Place and compact AASHTO No. 8 coarse aggregate or with material recommended by the pipe manufacturer, to a height of 12 inches over the pipe or conduit.
 - a. Carefully compact bedding under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Final Backfill:
 - 1. Trench Backfill Within 5 Feet of Pavement: Place and compact final backfill with PennDOT 408, Section 703 for 2A coarse aggregate to final subgrade elevation.
 - 2. Trench Backfill Beyond the Limits of Pavement: Place and compact final backfill with satisfactory soil to final subgrade elevation.

- G. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use PennDOT 408, Section 703 for 2A coarse aggregates.
 - 4. Under building slabs, use PennDOT 408, Section 703 for 2A coarse aggregates.
 - 5. Under footings and foundations, use PennDOT 408, Section 703 for 2A coarse aggregates.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within optimum moisture content recommended by the Engineer.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- D. Compaction: Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by the Engineer if soil density tests indicate inadequate compaction.
 - 1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum dry density, according to ASTM D698:

- a. Under concrete slabs, exterior concrete paving and concrete foundations, compact each layer of backfill or fill material at 98 percent of maximum dry density. Extend compacted area to 10 feet beyond the exterior face of the building.
 - b. Under lawn or unpaved areas, compact each layer of backfill or fill material at 92 percent of maximum dry density.
 - c. At exterior face foundation walls and walls beyond the exterior of the face of the building, each layer of backfill or fill shall be compacted to 95 percent of maximum dry density.
 - d. At asphalt and concrete paving the top 6 to 8 inches of subgrade under the subbase course shall be compacted to 98 percent of the maximum dry density. The aggregate subbase course shall also be compacted to 100 percent of the maximum dry density.
2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
- a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to the specified density.
 - b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
1. Turf or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1 inch.
 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBSURFACE DRAINAGE

- A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
- B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 12 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
 - 2. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade.

3.18 SUBBASE UNDER PAVEMENTS AND WALKS

- A. Place subbase course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course under pavements and walks as follows:
 - 1. Place subbase course under hot-mix asphalt pavement.
 - 2. Shape subbase course to required grades.
 - 3. Place subbase course 6 inches or less in compacted thickness in a single layer.
 - 4. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 5. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- C. Pavement Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 - 2. Determine that fill material classification and maximum lift thickness comply with requirements.

3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.
- E. Testing agency will test compaction of soils in place according to ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than four tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 312513 - EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Labor, equipment, and materials required to control soil erosion and sedimentation from the site during construction activities.
- B. Related Requirements:
 - 1. Provisions of the Contract Documents, including requirements of Division 1, apply to the work of this Section.
 - 2. Section 31 20 00 – Earth Moving
 - 3. Section 31 05 16 – Aggregate Materials
 - 4. Section 31 05 19 – Geotextiles
 - 5. Soil Erosion and Sedimentation Control Plan

1.2 REFERENCES

- A. PADOT Specification, Publication 408, Latest Edition
- B. PADEP Soil Erosion and Sediment Pollution Control Program Manual
- C. Erie County Conservation District Erosion and Sediment Control Plan

1.3 SUBMITTALS

- A. Comply with Division 1 requirements for submittals.
- B. Submit materials certificate signed by material supplier and Contractor, certifying that materials comply with, or exceed, the requirements of this Section.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. The contractor shall protect adjacent properties and water resources from erosion and sediment damage throughout the life of the contract.
- B. Comply with the provisions of the approved Soil Erosion and Sedimentation Control Plan for the site.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Erosion and Sedimentation Control Plan
- B. PADOT Specification, Publication 408, Latest Edition
- C. PADEP Soil Erosion and Sediment Pollution Control Program Manual
- D. Erie County Conservation District Erosion and Sediment Control Plan

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide the soil erosion and sediment control measures and permits necessary to meet the requirements of the jurisdictional authorities.
- B. Provide additional erosion and sediment control measures necessary or modify the construction procedures to meet the requirements of the Owner.
- C. The Contractor shall follow the sequence of construction as described on the Contract Drawings.

3.2 PREPARATION

- A. Review the approved Soil Erosion and Sedimentation Control Plan.
- B. Deficiencies or changes in the Soil Erosion and Sedimentation Control Plan as it is applied to current conditions will be brought to the attention of the Owner for remedial action.

3.3 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

- A. Place erosion control systems in accordance with the Soil Erosion and Sedimentation Control Plan and pursue the construction in accordance with the sequence outlined in the plan.
- B. The Owner has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to direct the contractor to provide immediate permanent or temporary pollution control measures. The contractor will be required to incorporate permanent erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut and fill slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and practical.
- C. Soil erosion and sedimentation control facilities will be inspected weekly and after every runoff event. Repairs and maintenance will be performed by the Contractor as required to maintain the integrity of the measures and facilities. Any deficiencies must be corrected by the Contractor immediately upon identification of the deficiency. Maintenance measures are the responsibility of the Contractor.
- D. Additional material and work required beyond the extent of the Soil Erosion and Sedimentation Control Plan shall be paid for by the Owner.
- E. Disturbed areas on which no construction activities are anticipated for twenty (20) days or longer will be seeded and will be inspected weekly (and after every runoff event) and reseeded as required to establish and maintain vegetation.
- F. Sediment taken from the erosion control facilities will be spread and dried for use in on-site

grading. Unsuitable material shall be hauled from the Site for proper disposal.

- G. Sediment will not be allowed to enter waters of the Commonwealth during either sediment removal or disposal operations.
- H. At the end of each construction day, sediment deposited on public roadways will be removed and returned to the construction Site. Public roadways will not be washed with water.

END OF SECTION

SECTION 321216 - ASPHALT PAVING

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. Hot-mix asphalt patching.
 - 2. Hot-mix asphalt paving.
 - 3. Asphalt surface treatments.
- B. Related Requirements:
 - 1. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
 - 2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 - 3. Job-Mix Designs: For each job mix proposed for the Work.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and testing agency.

- B. Material Certificates: For each paving material. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.
- C. Material Test Reports: For each paving material, by a qualified testing agency.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by PennDOT.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of PennDOT for asphalt paving work.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Prime Coat: Minimum surface temperature of 90 deg F.
 - 2. Tack Coat: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 3. Slurry Coat: Comply with weather limitations with weather limitations in PennDOT standard specification Section 409.3(b) except do not place if the air temperature is 50 deg F or lower, or if the pavement temperature is 50 deg F or lower.
 - 4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate
 - 1. This and elongated pieces, maximum percent as specified in AASHTO M 323, Table 5, for flat and elongated.
 - 2. Crushed fragments, minimum percent as specified in AASHTO M 323, Table, for fractured faces, coarse aggregates.

C. Fine Aggregate

1. Determine the uncompacted void content according to AASHTO T 304, Method A, and conform to AASHTO M 323, Table 5.
2. Determine the sand-equivalent value according to AASHTO T 176 and conform to AASHTO M 323, Table 5.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: PennDOT Superpave Asphalt Mixture Design, PG 64-22.
- B. Asphalt Cement: PennDOT Superpave Asphalt Mixture Design, PG-64-22.
- C. Water: Potable.

2.3 AUXILIARY MATERIALS

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires, asphalt shingles, or glass from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.
- B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.
- C. Sand: ASTM D 1073, Grade No. 2 or No. 3.
- D. Paving Geotextile: Complying with Section 735 - Geotextiles of PennDOT Publication 408, Specifications, latest edition, designed for paving applications.
- E. Joint Sealant: ASTM D 6690, Type I, hot-applied, single-component, polymer-modified bituminous sealant.

2.4 MIXES

- A. Surface Course Limit: Recycled content no more than 10 percent by weight.
- B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by PennDOT and complying with the following requirements:
 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 2. Base Course: PennDOT PG-64-22
 3. Surface Course: PennDOT PG 64-22.
- C. Emulsified-Asphalt Slurry: ASTM D 3910, Type 1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll subgrade until it does not rut under a loaded triaxle weighing a minimum of 75,000 lbs.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

- A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseal concrete pieces firmly.
 - 1. Undersealing: Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseal pieces firmly.
 - 2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.03 to 0.08 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- E. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
 - 1. Clean cracks and joints in existing hot-mix asphalt pavement.
 - 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
 - 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
 - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.
- D. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
 - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.
- E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.03 to 0.08 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 2. Place hot-mix asphalt surface course in single lift.
 3. Spread mix at a minimum temperature of 250 deg F.
 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
 2. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent or greater than 100 percent.
 - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041/D 2041M, but not less than 90 percent or greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549/D 3549M.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979/D 979M.
 - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041/D 2041M, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726/D 2726M.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726/D 2726M.
- F. Replace and compact hot-mix asphalt where core tests were taken.
- G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 WASTE HANDLING

- A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 321216

SECTION 32 13 13 - CURBS AND SIDEWALKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation and placement of Portland cement concrete curb
2. Preparation and placement of Portland cement concrete sidewalk.

B. Related Requirements:

1. Section 31 20 00 – Earth Moving
2. Section 03 30 00 – Cast-in-Place Concrete
3. Section 31 05 19 – Geotextiles
4. Section 03 30 00 – Cast-in-place Concrete
5. Contract Drawings.

1.2 REFERENCE STANDARDS

A. American Concrete Institute (ACI) latest edition

- | | |
|------|--|
| 304R | Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete |
| 308 | Standard Practice for Curing Concrete |

B. American Society for Testing and Materials (ASTM) latest edition

- | | |
|--------|---|
| A 615 | Deformed and Plain Billet-Steel for Concrete Reinforcement |
| C 33 | Concrete Aggregates |
| C 94 | Ready-Mixed Concrete |
| C 150 | Portland Cement |
| C 260 | Air-Entraining Admixtures for Concrete |
| C 309 | Liquid Membrane-Forming Compounds for Curing Concrete |
| C 494 | Chemical Admixtures for Concrete |
| D 1751 | Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |

C. FS TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.

D. PADOT Specification, Publication 408, latest edition.

1.3 QUALITY ASSURANCE

A. Establish and maintain required lines and elevations.

B. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable work as directed by Owner.

1.4 SUBMITTAL

A. Comply with Division 1 requirements for submittals.

B. Submit materials certificate to Independent Testing Laboratory, which is signed by materials

producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein.

1.5 PROJECT CONDITIONS

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Forms shall be of depth equal to depth of curbing or sidewalk, and so designed as to permit secure fastening together at tops. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.
- B. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40.
- C. Concrete Materials: Comply with requirements of Section 03300 for concrete materials, admixtures, bonding materials, curing materials, and others as required.
- D. Joint Fillers: Cork or sponge rubber in accordance with AASHTO M153, or fiber per PADOT Publication 408, Section 705.1.
- E. Joint Sealers: Rubberized joint sealing material in accordance with ASTM D3405 or AASTM D1190.

2.2 MIX DESIGN AND TESTING

- A. Concrete mix design and testing shall comply with requirements of Section 03 30 00.
- B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
 - 1. Slump Range: 1 to 3 in. at time of placement.
 - 2. Air Entrainment: 5 to 8 percent

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proof roll prepared base material surface to check for unstable areas. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.
- B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.
- C. Place No. 2A Subbase for sidewalks to a thoroughly compacted bed 4 inches deep, or in accordance with plan documents.

3.2 INSTALLATION

A. Form Construction

1. Set forms to required grades and lines, rigidly braced and secured.
2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
3. Check completed formwork for grade and alignment to following tolerances:
Top of forms not more than 1/8-in. in 10'-0"
Vertical face on longitudinal axis, not more than
1/4-in. in 10'-0"
4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Concrete Placement

1. Place concrete in accordance with requirements of Section 03 30 00.
2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structures until they are at required finish elevation and alignment.
3. Place concrete using methods, which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint. Automatic machine may be used for curb and gutter placement. Machine placement must be at required cross section, line, grade, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified herein.
5. Check alignment, cross section, grade, and finish of concrete after forms are removed, if the concrete does not meet the tolerances in these Contract Documents, then remove and replace concrete at no cost to Owner.

C. Joint Construction

1. Contraction Joints: Concrete curb and sidewalk, where specified on Contract Drawings, shall be constructed in uniform sections of length specified on Contract Drawings. Joints between sections shall be formed as shown on the Contract Drawings, of length equal to width of curb and gutter, and with depth which will penetrate at least 2-in. below surface of sidewalk, curb and gutter; or by sawing to depth of at least 2-in. while concrete is between 4 and 24 hours old. If steel templates are used, they shall be left in place until

concrete has set enough to hold its shape, but shall be removed while forms are still in place.

2. Transverse Expansion Joints: Concrete curb and sidewalk, shall have filler cut to exact cross section of curb and sidewalk. Joints shall be similar to type of expansion joint used in adjacent pavement.

- D. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2-in. or more than 1-in. below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.
- E. Joint Sealants: Joints shall be sealed with approved exterior pavement joint sealants and shall be installed in accordance with manufacturer's recommendations.

3.3 CONCRETE FINISHING

- A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.

- B. Work edges of gutters, back top edge of curb, and formed joints with edging tool, rounding as shown on the Contract Drawings. Eliminate tool marks on concrete surface. After completion of floating and trowelling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

Curbs, gutters and sidewalks: Broom finish by drawing fine-hair broom across surface perpendicular to flow of traffic. Repeat operation as necessary to produce fine line texture.

- C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Owner.
- D. Protect and cure finished concrete paving using acceptable moist-curing methods, more particularly described in "water-curing" section of ACI 308.

3.44 BACKFILL

- A. After concrete has set sufficiently, spaces on either side of curb shall be refilled to required elevation with suitable material compacted in accordance with Section 31 20 00 – Earth Moving.

3.05 CLEANING AND ADJUSTING

- A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.
- B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

END OF SECTION

SECTION 331116 – SITE UTILITY WATER SERVICE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings for Site water line, including domestic water line.
 - 2. Tapping sleeves and valves.
 - 3. Valves.
 - 4. Underground pipe markers.
 - 5. Valve boxes.
 - 6. Bedding and cover materials.

- B. Related Requirements:
 - 1. Section 31 20 00 – Earth Moving: Product and execution requirements for excavation and backfill required by this Section.
 - 2. Disinfecting of Water Utility Distribution: Disinfection of Site service utility water piping in accordance with the authority having jurisdiction.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. ASTM International:
 - 1. ASTM A48 - Standard Specification for Gray Iron Castings.
 - 2. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
 - 3. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)).
 - 4. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
 - 5. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

- C. American Water Works Association:
 - 1. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
 - 2. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
 - 3. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm) for Water Service.
 - 4. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

- D. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP-60 - Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on pipe materials, pipe fittings, valves, and accessories.
- C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, valves, connections, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 - PRODUCTS

2.1 WATER PIPING

- A. Copper Tubing:
 - 1. Comply with ASTM B88.
 - 2. Type K annealed.
 - 3. Fittings: ASME B16.18, cast copper or ASME B16.22, wrought copper.
 - 4. Joints: Compression connection.
- B. Polyethylene Pipe:
 - 1. Pipe: Comply with AWWA C901 or ASTM D3035, DR 11 for 160 psig.
 - 2. Fittings: Comply with AWWA C901.
 - 3. Joints: Compression or Butt fusion.

2.2 TAPPING SLEEVES AND VALVES

- A. Tapping Sleeves:
 - 1. Furnish materials in accordance with the authority having jurisdiction.
- B. Description:
 - 1. Material: Stainless steel, split sleeve type of the size indicated with flanged outlet and with bolts, follower rings and gaskets on each end of the sleeve.
 - 2. Type: Dual compression.
 - 3. Outlet Flange Dimensions and Drilling: Comply with ASME B16.1, Class 125 and MSS SP-60.
- C. Tapping Valves:

D. Description:

1. Comply with AWWA C500.
2. Type: Double disc with non-rising stem.
3. Inlet Flanges: Comply with ASME B16.1, Class 125, and MSS SP-60.
4. Mechanical Joint Outlets: Comply with AWWA C111.
5. Mark manufacturer's name and pressure rating on valve body.

2.3 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape:

1. Brightly colored, continuously printed.
2. Minimum 6 inches wide by 4 mil thick.
3. Manufactured for direct burial service.

2.4 VALVE BOXES

A. Description:

1. Valve boxes and covers.
2. Material: Cast iron.
3. Type: Extension, with slide adjustment.
4. Covers marked WATER SERVICE.

2.5 MATERIALS

A. Bedding and Cover:

1. Bedding: As specified in Section 31 20 00 – Earth Moving.
2. Cover: As specified in Section 31 20 00 – Earth Moving.
3. Soil Backfill from Above Pipe to Finish Grade: As specified in Section 31 20 00 – Earth Moving.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that building service connections and municipal utility water main sizes, locations, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.

- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare pipe connections to equipment with flanges or unions.
- E. Protect and support existing distribution piping and appurtenances as Work progresses.

3.3 INSTALLATION

- A. Bedding:
 - 1. Excavate pipe trench as specified in Section 31 20 00 - Earth Moving.
 - 2. Place bedding material at trench bottom.
 - 3. Level fill materials in continuous layers not exceeding 6 inches compacted depth.
 - 4. Compact to 95 percent of maximum dry density. Comply with ASTM D698.
 - 5. Backfill around sides and to top of pipe with cover fill, tamp in place, and compact to 95 percent of maximum density.
- B. Piping:
 - 1. Maintain separation of water main from sewer piping as indicated on Drawings.
 - 2. Group piping with other Site piping work whenever practical.
 - 3. Install pipe to elevations indicated on Drawings.
 - 4. Route pipe in straight line.
 - 5. Install access fittings to permit disinfection of water system.
 - 6. Pipe Markers:
 - a. Install plastic ribbon tape continuous over top of pipe buried 12 inches below finish grade, above piping.
 - 7. Backfill trench as specified in Section 31 20 00 - Earth Moving.
- C. Valves:
 - 1. Set valves on solid bearing.
 - 2. Valve Box:
 - a. Center and plumb valve box over valve.
 - b. Set box cover flush with finished grade.
- D. Service Connections:
 - 1. Install water service in accordance with the authority having jurisdiction.
 - 2. Install water service to 5 feet of building and connect to building water service.
- E. Disinfection:
 - 1. Flush and disinfect system in accordance with the authority having jurisdiction.

3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.
- B. Perform pressure test on domestic site water service line in accordance with the authority having jurisdiction.
- C. Compaction Testing for Bedding: Comply with ASTM D698.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION

SECTION 33 31 00 - SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sanitary sewerage piping.
 - 2. Pipe markers.
 - 3. Manholes.
 - 4. Bedding and cover materials.

- B. Related Requirements:
 - 1. Section 03 30 00 - Cast-In-Place Concrete: Concrete type for manhole base pad construction.
 - 2. Section 03 30 00 - Cast-in-Place Concrete: Non-shrink grout.
 - 3. Section 04 20 00 - Masonry Mortaring and Grouting: Masonry grout.
 - 4. Section 22 13 16 – Sanitary Waste and Vent Piping: Product and execution requirements for sanitary waste and vent piping at building.
 - 5. Section 31 20 00 - Earth Moving: Soils for backfill in trenches. Aggregate for backfill in trenches. Product and execution requirements for excavation and backfill required by this Section. Execution requirements for trenching required by this Section. Requirements for backfill to be placed by this Section.

1.2 DEFINITIONS

- A. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. ASTM International:
 - 1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
 - 2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 4. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 5. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
 - 6. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

- C. American Water Works Association:
 - 1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

1.4 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
- B. Coordinate Work of this Section with termination of sanitary sewer connection outside building, connection to municipal sewer utility service.

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information indicating pipe material and accessories to be used.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Indicate special procedures required to install specified products.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for closeout procedures.
- B. Project Record Documents: Record locations of pipe runs, connections, manholes, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

- A. Perform Work according to Municipality standards.

1.8 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SANITARY SEWERAGE PIPING

- A. Plastic Pipe:
 - 1. Material: Polyvinyl chloride (PVC).
 - 2. Comply with ASTM D3034, SDR-35.
 - 3. End Connections: Bell and spigot style, with rubber-ring-sealed gasket joint.
 - 4. Fittings: PVC.

5. Joints:
 - a. Elastomeric gaskets.
 - b. Comply with ASTM F477.

2.2 MANHOLES

- A. Manhole Lid and Frame:
 1. Material: In accordance with municipality standards.
 2. Lid Design: In accordance with municipality standards.
 3. Nominal Lid and Frame Size: In accordance with municipality standards.
- B. Shaft and Eccentric Cone Top Section:
 1. Material: Reinforced precast concrete sections.
 2. Joints: Lipped male/female, gaskets conforming to ASTM C443.
 3. Joints between Manhole and Pipes: Resilient connectors conforming to ASTM C923.
 4. Ladder Rungs:
 - a. Material: Cast steel. Plastic or rubber coated pressure-molded to the steel. Plastic coating conforming to ASTM D4101, copolymer polypropylene. Rubber conforming to ASTM C443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted.
 - b. Spacing in Shaft Sections: 12 o.c.
 5. Nominal Shaft Section Diameter: 48 inches.
- C. Base Pad:
 1. Material: Cast-in-place concrete as specified in Section 03 30 00 - Cast-in-Place Concrete.
 2. Top Surface: Leveled to receive concrete shaft sections.

2.3 MATERIALS

- A. Bedding and Cover:
 1. Bedding: As specified in Section 31 20 00 – Earth Moving.
 2. Cover: As specified in Section 31 20 00 – Earth Moving.
 3. Soil Backfill from Above Pipe to Finish Grade: As specified in Section 31 20 00 Earth Moving.

2.4 UNDERGROUND PIPE MARKERS

- A. Plastic Ribbon Tape:
 1. Brightly colored, continuously printed.
 2. Minimum 6 inches wide by 4 mil thick.
 3. Manufactured for direct burial service.

2.5 MIXES

- A. Grout: As specified in Section 03 30 00 – Cast-in-Place Concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

- B. Verify that excavation base is ready to receive Work.
- C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Correct over-excavation with coarse aggregate.
- C. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.
- D. Protect and support existing sewer lines, utilities, and appurtenances.
- E. Utilities:
 - 1. Maintain profiles of utilities.
 - 2. Coordinate with other utilities to eliminate interference.
 - 3. Notify Engineer if crossing conflicts occur.

3.3 INSTALLATION:

- A. Bedding:
 - 1. Excavate pipe trench as specified in Section 31 20 00 – Earth Moving.
 - 2. Place bedding material at trench bottom.
 - 3. Level materials in continuous layer not exceeding 8 inches.
 - 4. Maintain optimum moisture content of bedding material to attain required compaction density.
- B. Piping:
 - 1. Install pipe, fittings, and accessories according to manufacturer's recommendations, and seal joints watertight.
 - 2. Lay pipe to slope gradients as indicated on Drawings.
 - 3. Maximum Variation from Indicated Slope: 1/8 inch in 10 feet.
 - 4. Install bedding at sides and over top of pipe, to minimum compacted thickness of 12 inches.
 - 5. Backfill and compact as specified in Section 31 20 00 – Earth Moving.
 - 6. Do not displace or damage pipe when compacting.
 - 7. Connect to building sanitary sewer outlet and municipal sewer system.
 - 8. Pipe Markers: As specified.
 - 9. Install Site sanitary sewage system piping to within 5 feet of building, and connect to building sanitary waste system.
- C. Manholes:
 - 1. Excavate for manholes as specified in Section 31 20 00 – Earth Moving.
 - 2. Form bottom of excavation clean and smooth, and to correct elevation.
 - 3. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
 - 4. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.
 - 5. Mount lid and frame level in grout, secured to top cone section to indicated elevation.

3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

3.5 PROTECTION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 40 00 - STORM SEWER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm sewer includes, but is not limited to: storm drainage piping, fittings, accessories, bedding, manholes, and inlets.

B. Related Requirements:

1. Section 31 20 00 – Earth Moving
2. Section 03 30 00 – Cast-in-Place Concrete
3. Section 31 05 19 – Geotextiles
2. Section 31 05 16 – Aggregate Materials

1.2 REFERENCE STANDARDS

A. Millcreek Township, Erie County applicable code requirements.

B. Pennsylvania Department of Transportation (PADOT):

1. Publication 408 - Specifications
2. Publication 35 - Approved Construction Materials (Bulletin 15)
3. Publication 72 - Standards for Roadway Construction

C. American Society for Testing and Materials (ASTM)

1. A48 - Specification for Gray Iron Castings.
2. C32 - Specification for Sewer and Manhole Brick.
3. C139 - Specifications for Concrete Masonry Units for Construction of Catch Basins and Manholes.
4. C270 - Specifications for Mortar for Unit Masonry.
5. C443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
6. C478 - Specifications for Precast Reinforced Concrete Manhole Sections.
7. C923 - Specification for Resilient Connections Between Reinforced Concrete Manhole Structures and Pipes.
8. D1785 - Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
9. D2241 - Specification for Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR).
10. D3034 - Specification for Type PMS Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
11. F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
12. F679 - Specification for Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
13. F789 - Specifications for Type PS46 Polyvinyl Chloride (PVC) Plastic Gravity Sewer Pipe and Fittings.
14. F 794 - Specification for Polyvinyl Chloride (PVC) Large Diameter Ribbed Gravity Sewer Pipe and Fittings Based on Controlled inside Diameter.

15. F 949 - Specification for Polyvinyl Chloride (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.

- D. American Association of State Highway and Transportation Officials (AASHTO)
 - 1. T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-inch (457 mm) Drop.
 - 2. M252 - Corrugated Polyethylene Drainage Tubing, 3" to 10" diameter
 - 3. M294 - Corrugated Polyethylene Pipe, 12" to 48" diameter

1.3 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of pipe runs, connections and invert elevations.
- B. Identify and describe unexpected variations in subsoil conditions or discovery of uncharted utilities.

1.4 SUBMITTALS

- A. Comply with the provisions of Division 1 for submittals.
- B. Certificates
 - 1. Submit materials certificates and shop drawings for materials listed in Part 2 - Products signed by material supplier and Contractor, certifying that materials comply with, or exceed, the requirements of this Section.
- C. Shop Drawings
 - 1. Manholes
 - a. Submit detailed shop drawings of manhole sections, precast manhole bases, manhole steps, manhole frames and covers (with inscription), and manufacturers' descriptive literature for the pipe to manhole flexible connections (if used). Shop drawings for manholes over four (4) feet in diameter shall be sealed by a Professional Engineer registered in the Commonwealth of Pennsylvania.
 - 2. Inlets
 - a. Submit detailed shop drawings of inlet units, inlet tops, grates and frames including reinforcing steel details, as applicable. A Professional Engineer registered in the Commonwealth of Pennsylvania shall seal shop drawings for modified inlet boxes.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Precast Concrete Units:
 - 1. After fabrication and curing, transport the units to the job site. Protect until required for installation.
 - 2. Handle to avoid damage to surfaces, edges and corners to avoid creation of stresses within the units. Damaged materials shall be removed from the job site.
- B. Storm Sewer Pipe:
 - 1. During loading, transporting and unloading, exercise care to prevent damage to materials.
 - 2. Do not drop pipe or fittings.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Manufacturers of all materials shall be listed in PADOT Bulletin 15.

2.2 PIPE

- A. Smooth-Lined Corrugated Polyethylene Pipe (SLCPP)
 - 1. Conform to AASHTO designation M252 and M294.
 - 2. Joints shall be watertight to a minimum water pressure of 10 psi, and as indicated on the Contract Drawings.
- B. PVC Gravity Sewer Piping:
 - 1. Pipe and Fittings: ASTM F 679, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.
- C. Concrete Pipe (RCP)
 - 1. Conform to ASTM C 76, Class III
 - 2. Performance requirements for joints in reinforced concrete pipe shall conform to AASHTO M 198
- D. Corrugated-Steel Pipe and Fittings: ASTM A 760/A 760M, Type I with fittings of similar form and construction as pipe.
 - 1. Special-Joint Bands: Corrugated steel with O-ring seals.
 - 2. Standard-Joint Bands: Corrugated steel.
 - 3. Coating: Aluminum.

2.3 CAST-IN-PLACE CONCRETE

- A. PADOT Class A. Comply with requirements in Section 03 30 00 - Cast-in-Place Concrete.

2.4 NON-STRUCTURAL GROUT

- A. Comply with Section 601.2(c), PADOT Publication 408.

2.5 GEOTEXTILE MATERIAL

- A. Comply with Section 02273 - Geotextiles of these Specifications.

2.6 AGGREGATE MATERIALS

- A. Comply with Section 02227 - Aggregate Materials of these Specifications.

2.7 MANHOLES AND APPURTENANCES

- A. Manufacturer must be listed in PADOT Bulletin 15.
- B. Comply with PADOT Standard Drawing RC-39, Publication 72, except as specified herein.
- C. Top sections shall have a 30-inch minimum diameter clear opening.

- D. Bituminous waterproof material shall meet the requirements of PADOT Publication 408, Section 680.2(a).
- E. Manhole frames and covers shall be gray iron conforming to the minimum requirements of ASTM A48-83, Class 35B. Frames and covers shall be solid with "STORM SEWER" stamped thereupon.
- F. Manhole steps shall be polypropylene coated steel reinforcing bars cast in place during manhole fabrication. Steel shall be a deformed reinforcing bar either No. 3, Grade 60 or No. 4, Grade 40, meeting the minimum requirements of AASHTO M31. Steps shall have a flat serrated tread with end lugs to prevent feet from slipping off.

2.8 INLETS

- A. Manufacturer must be listed in PADOT Bulletin 15.
- B. Comply with PADOT Standard Drawing RC-34, Publication 72.
- C. Inlet grates as specified on the Contract Drawings.

2.9 MAGNETICALLY DETECTABLE UTILITY MARKING TAPE

- A. Width: three (3) inches, minimum
- B. Type: five (5) mil minimum thickness (i.e. one (1) mil continuous aluminum foil layer between 2-2 mil clear film) material, each side reverse printed with the message repeated every \pm twenty-four (24) inches.

2.10 CONCRETE FOR PIPE ENCASEMENT

- A. Comply with the requirements of PADOT Publication 408, Section 704.1; Class A minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that trench cuts and excavations are ready to receive work and that excavations, dimensions, and elevations are as indicated on Contract Drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with specified bedding material.
- B. Remove large stones or other hard matter, which could damage piping or impede consistent backfilling or compaction.
- C. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

- D. Give ample notice to the Owner or Owner's representative in advance of pipe laying operations.

3.3 BEDDING

- A. Excavate pipe trench and place bedding material in accordance with Section 02300 - Earthwork. Place aggregate in a manner to avoid segregation, and compact to the maximum practical density so that the pipe can be laid to the required tolerances.

3.4 PIPE INSTALLATION

- A. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to pipe. Do not drop pipe.
- B. Lay pipe proceeding upgrade.
- C. Lay pipe to a true uniform line with the barrel of the pipe resting solidly in bedding material throughout its length. Excavate recesses in bedding material to accommodate joints, fittings, and appurtenances.
- D. Lay each section of pipe to form a close concentric joint with the adjoining section and to avoid offsets in the flow line.
- E. Clean and inspect each pipe and fitting before joining. Align pipe with previously laid sections. Assemble to provide tight, flexible joints that permit movement caused by expansion, contraction, and ground movement. Assemble joints in accordance with the pipe manufacturer's instructions.
- F. Assemble joints in accordance with recommendations of the manufacturer and as follows:
 - 1. Reinforced Concrete Pipe Joints:
 - a. Wipe clean end of the pipe and inside of rubber gasket. Equalize gasket circumferential tension.
 - b. Apply joint lubricant.
 - c. Align pipe with previously laid sections. Insert pipe into coupling, bell or groove and force into place to the bottom of the socket.
 - d. After joint assembly, check rubber ring location with a suitable gage.
 - e. Mortar all joints. All joints shall be watertight.
- G. Check each pipe installed as to line and grade in place. Each pipe shall be laid within one foot (1') horizontally and 0.1 feet vertically of the design location. Deviations shall be corrected immediately. A deviation from the design grade as shown on the Contract Drawings exceeding these limits will be cause for rejection. Deflection of pipe joints in excess of 80 percent of the maximum deflection of those specified by the manufacturer will be cause for rejection.
- H. Remove and replace pipe which is not true to alignment; shows settlement after installation, is broken, or is damaged.
- I. Place aggregate at sides and over top of pipe. Provide top cover to minimum thickness indicated on the Contract Drawings. Compact to 100% of dry weight density. Do not displace or damage pipe when compacting.

- J. Place and compact sufficient backfill to hold each section of pipe firmly in place as the pipe is laid.
- K. Pipe ends shall be flush with the interior face of drainage structure walls. Pipes ends protected by endwalls shall be flush with the exposed face of the endwall. All connections to structures shall be grouted in place and finished with mortar. All connections shall be watertight.
- L. Construct cast-in-place concrete slope anchors in accordance with, and at the locations shown on, the Contract Drawings.

3.5 CONCRETE ENCASEMENT

- A. Encasement of the storm sewer line with concrete shall be installed where required to meet facility separation requirements. Care shall be exercised in placing encasement to provide adequate anchorage for the storm sewer line in order to preclude flotation and/or displacement of the pipe.

3.6 MANHOLE INSTALLATION

- A. Perform excavation to the line and grade shown on the Contract Drawings and as specified in Section 31 00 00 – Earthwork.
- B. Location and depth of manholes as shown on the Contract Drawings.
- C. Construct watertight manholes of precast concrete sections of the type shown on the Contract Drawings.
- D. Provide cast-in-place concrete or precast concrete bases.
 - 1. Place precast units on a crushed stone subbase placed and compacted in 4-inch layers to 95% of dry weight density, as shown on the Contract Drawings.
 - 2. Construct cast-in-place units on undisturbed earth.
 - 3. Construct cast-in-place bases as shown on the Contract Drawings.
 - a. Cast-in-place bases may be constructed with a special form for a joint to match the manhole cylinder sections.
 - 4. Install precast bases as shown on the Contract Drawings.
 - a. Provide a sealed, flexible, resilient connection between pipe and precast base section.
- E. Seal joints between precast concrete manhole sections with preformed joint sealant compound and rubber gaskets.
 - 1. Place joint sealant compound on lower section to be squeezed by the weight of the upper section.
 - 2. Place rubber gasket in groove formed in spigot end. Equalize gasket tension.
- F. Install manhole sections with steps in proper vertical alignment.
- G. Use precast manhole rings to achieve elevation shown for frame and cover. Do not adjust elevation more than one (1) foot with precast rings. Seal joints between rings and adjacent components with joint sealant compound. Anchor frame to manhole with anchor bolts.

- H. Where new manholes are to be constructed on existing pipelines, carefully excavate around existing pipeline for placement of the new manhole base. Take all measures necessary to control flow through the existing pipeline and to prevent leakage into the new base. After completion of the manhole, carefully remove the top portion of the existing pipeline.

3.7 INLET INSTALLATION

- A. Perform excavation in conjunction with storm sewer pipe installation, and as specified in Section 02300 - Earthwork.
- B. Locate inlets as indicated on the Contract Drawings.
- C. Construct inlets of either precast sections or of cast-in-place construction to the dimensions and design of Standard Drawings RC-34, PADOT Publication 72, and of the type indicated on the Contract Drawings.
 - 1. Place precast units on a crushed stone subbase placed and compacted in 4-inch layers to 95% of dry weight density, as shown on the Contract Drawings.
 - 2. Construct cast-in-place units on undisturbed earth.
 - 3. Install specified inlet frames and grates. Set tops of frames at finished grade elevation or other elevation as shown on the Contract Drawings. Inlet grates in turf or paved areas will be level with the finished surface unless otherwise noted. Seal joint between frame and inlet walls with joint sealant compound.
 - 4. Form flow channels in inlet bases. Where changes in flow direction are required, begin flow channel curve where influent pipe penetrates inlet wall, and end curve where effluent pipe penetrates inlet wall; straight flow channel sections are not acceptable. Slope channels uniformly from influent invert to effluent invert to prevent water from standing in box. Form channel sides and invert smoothly and uniformly; free of cracks, holes or protrusions.
 - 5. Unless units are cast-in-place, use precast concrete rings or brick to adjust to grade; mortar in place.
 - 6. Install proper grates at proper locations as indicated on the Contract Drawings.

3.8 GRADE

- A. Install structures at the locations and elevations shown on the Contract Drawings. Invert elevations that differ more than 1/4 inch from the elevations shown on the Contract Drawings shall be grounds for rejection.

3.9 BACKFILLING TRENCHES

- A. Backfill pipeline trenches only after examination of pipe installation by the Owner or Owner's representative.
- B. Backfill and compact trenches as specified in Section 31 00 00 - Earthwork.

END OF SECTION

SECTION 412213 - BRIDGE CRANES, OVERHEAD ELECTRIC, TOP RUNNING

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. Designing, manufacturing, shipping or installation of a 2-ton bridge crane, overhead electric, top running and testing of equipment after installation.

1.3 DEFINITIONS

- A. Crane Bridge: That part of an overhead crane system consisting of girder(s), end trucks, end ties, walkway, and drive mechanism which carries the trolley(s) and travels along the runway rails parallel to the runway.
- B. Crane Runway: The track system along which the crane operates horizontally, including track hangar rods, track connection devices, and runway structural supports.
- C. Dead Loads: The loads on a structure which remain in a fixed position relative to the structure.
- D. Girder: The principal horizontal beam of the crane bridge. It is supported by the crane end trucks.
- E. Live Load: A load which moves relative to the structure under consideration.
- F. Pendant: A control for a hoist and/or a crane. The pendant hangs from the hoist or the crane by a cable at a height that is easy for the operator to reach.
- G. Rated Load: For the purpose of this specification the rated load is defined as the maximum working load suspended under the load hook.
- H. Standard Commercial Cataloged Product: A product which is currently being sold, or previously has been sold, in substantial quantities to the general public, industry or Government in the course of normal business operations. Models, samples, prototypes or experimental units do not meet this definition. The term "cataloged" as specified in this section is defined as "appearing" on the manufacturer's published product data sheets. These data sheets must have been published or copyrighted prior to the issue date of this solicitation and have a document identification number or bulletin number.

- I. Top Running Crane: An electric overhead traveling crane that runs on rails on top of support girders.
- J. Trolley Mounted Hoist: A combined unit consisting of a wheeled trolley that provides horizontal motion along the bridge girder, and a hoist supported by the trolley, that provides lifting and lowering of a freely suspended load.

1.4 REQUIREMENTS

- A. The requirements for the crane runway system and rail supporting structures must conform to AISC 325.

1.5 VERIFICATION OF DIMENSIONS

- A. The Contractor is responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. Verify all dimensions of the building that relate to fabrication of the crane and notify the Contracting Officer of any discrepancy before finalizing the crane order

1.6 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 4. Review areas where existing construction is to remain and requires protection.

1.7 SUBMITTALS

- A. Shop Drawings: Overhead electric crane.
- B. Product Data: Gear Reducers, Hook, Trolley, Inverter Drives, Control Parameter Settings, Hoist, Controls, Couplings, Pendant pushbutton station, Electrification, Motors, Brakes, Capacity, Overload Protective Device, and Limit Switches.
- C. Design Data: Load and sizing calculations.
- D. Test Reports: Hook and hook nut Tests, Wire rope breaking strength, Post-erection inspection, Operational Tests, Hook Proof Test, No-load Test, and Load Tests:
- E. Certificates: Overload Test Certificate, Loss of Power (Panic Test) Certificate, Hazardous Material Certificate, Certificate of the Coupling Alignment Verification Record, Brake Setting Record, and Certificate of Compliance with Listed Standards.

- F. Operation and Maintenance Data: Overhead electric crane; including weekly, monthly, semi-annual, and annual required maintenance items

1.8 COORDINATION

- A. Arrange schedule so as not to interfere with Airport operations.

1.9 QUALITY ASSURANCE

- A. Manufacturer Qualification

- 1. Overhead electric crane system, including sub-system components manufactured by vendors, must be designed and manufactured by a company with a minimum of 10 years of specialized experience in designing and manufacturing the type of overhead crane required to meet requirements of the Contract Documents.

- B. Pre-Delivery Inspections

- 1. Contractor is responsible for performance of quality control inspections, testing and documentation of steel castings, hook assembly and trolley as follows.

- a. Inspection of Steel Castings; Visually inspect and test load-carrying steel castings using the magnetic-particle inspection method. Reference allowable degree of discontinuities to ASTM E125, and relationship to service loads and stresses, critical configuration, location and type. All load bearing components, couplings, shafts, and gears, in the hoist drive train must be rolled or forged steel, except brake drums which may be ductile iron. Methods of repairing the discontinuities is subject to review by the Contracting Officer.

- b. Inspection of Hook Assembly; Inspect hook and nut by a magnetic-particle type inspection per subpart titled Hook and Hook Nut Magnetic-Particle Tests prior to delivery. Furnish documentation of hook inspection to Contracting Officer prior to field operational testing. As part of the acceptance standard, linear indications greater than 1/16 inch are not allowed. Welding repairs of hook are not permitted. A hook showing linear indications, damage or deformation is not acceptable and must be replaced immediately.

- c. Hook Proof Test; Proof test the load hook per ASME B30.10.

- 2. Certificates;

Submit an Overload Test Certificate stating that the crane can be periodically load tested to 125 percent (plus 5 minus 0) of rated load.

Submit a Loss of Power (Panic Test) Certificate stating that a test may be performed in which power is removed from the crane while the hoist, bridge, and trolley are in operation to simulate a loss of power.

Submit a Hazardous Material Certificate that the crane does not contain hazardous material, asbestos, lead, cadmium, chromium, PCBs or elemental mercury.

Submit a Certificate of Compliance with Listed Standards.

Submit a Certificate of the Coupling Alignment Verification Record.

Submit a Certificate of the Brake Setting Record

3. Drawings: Overhead Electric Crane

Submit shop drawings showing the general arrangement of all components in plan, elevation, and end views; hook approaches on all four sides, clearances and principal dimensions, assemblies of hoist, trolley and bridge drives, motor nameplate data, overcurrent protective device ratings, and electrical schematic drawings. Include weights of components and maximum bridge wheel loads and spacing.

Shop drawing quality must be equivalent to the contract drawings accompanying this solicitation. Drawings must be reviewed, signed and sealed by a registered professional engineer.

Provide integral schedule of crane components on each drawing. Provide maximum wheel loads (without impact) and spacing imparted to the crane runway system track beams. Indicate the crane speeds along the runway, the trolley speeds along the bridge girder, and the hoist lifting speeds; all speeds indicated are speeds with hoist loaded with rated crane capacity load.

4. Design Data: Load and Sizing Calculations

Submit calculations reviewed, signed and sealed by a registered professional engineer verifying the sizing of the bridge girder, end trucks, travel drives, and overcurrent protection for motors, controllers, and branch circuits. Include seismic analysis of bridge girder and end trucks.

5. Welding Qualifications and Procedures

Welding must be in accordance with qualified procedures using AWS D14.1/D14.1M as modified. Written welding procedures must specify the Contractor's standard dimensional tolerances for deviation from camber and sweep and not exceed those specified in AWS D14.1/D14.1M and CMAA 74. Welders and welding operators must be qualified in accordance with AWS D1.1/D1.1M or AWS D14.1/D14.1M. Allowable stress values must comply with CMAA 74.

C. CRANE SAFETY

Comply with the mandatory and advisory safety requirements of ASME B30.10, and NFPA 70. Submit data on Capacity Overload Protective Device

PART 2 - PRODUCTS

2.1 TOP RUNNING CRANE SYSTEM

A. Basis of Design; Konecranes CXT2 low headroom wire rope type.

- B. Provide top running overhead electric traveling (OET) crane conforming to CMAA 74, Class C for indoor service, ASME B30.2, with a vertical lift of 14 feet and as specified herein. The crane span must be as indicated, and be designed to operate in an ambient temperature between 40 and 105 degrees Fahrenheit.
- C. The crane must be pendant and operate in the spaces and within the loading conditions indicated. The pendant controller must be mounted on a separate festooned cable system from the trolley power supply. The crane must operate on 208-V, three phase power source. Maximum crane wheel loads (without impact) due to dead and live loads, with the trolley in any position, must not cause a more severe loading condition in the runway support structure than that produced by the design wheel loads and spacing indicated.
- D. Submit Overhead electric crane, Data Package 3, including recommended maintenance items on a weekly, monthly, semi-annual, and annual basis.
- E. Capacity; Provide a crane with a minimum rated capacity of 2 metric tons. Mark the rated capacity in both kilogram and pound units printed in different colors on both sides of the crane on the bridge girder. Capacity marks must be clearly visible to the operator at ground level.
- F. Speeds
 - 1. Hoist - two speed within 15% of 3.9 and 25 feet per minute
 - 2. Trolley - VFC with a top speed of 80 feet per minute
 - 3. Bridge - VFC with a top speed of 100 feet per minute

G. Hoist

Provide hoist conforming to ASME B30.2 and CMAA 74 Class C or better, double reeved, except as modified and supplemented in this section. Equip hoist with a spring set, electro-mechanically released brake plus a mechanical load brake.

H. Crane Safety

Comply with the mandatory and advisory safety requirements of ASME B30.2, CMAA 74, 29 CFR 1910.147, 29 CFR 1910.179, 29 CFR 1910.306, and all applicable provisions of 29 CFR 1910 and NFPA 70.

2.2 STRUCTURAL REQUIREMENTS

- A. Structural requirements must be in accordance with CMAA 74

2.3 MECHANICAL EQUIPMENT

Provide steel shafts, gears, keys, and couplings. Cast iron and aluminum used to support components of the hoist power transmission train must be ductile.

All bearings, except those subject only to small rocker motion, must be anti-friction type.

- A. Drives

1. Bridge Drives

Bridge drives must be A-4 drive arrangement as specified in CMAA 74.

Provide bridge drive consisting of a single electric motor mechanically connected through gear reduction and drive shafts to the drive wheels or separate drive motors at each end of bridge.

Acceleration and deceleration must meet the requirements specified in this section. Gears must conform to applicable AGMA standards. Provide oil tight fully enclosed gear reducers with pressure or splash type lubrication. Bridge-travel limit-switches are optional. Submit product data on inverter drives and control parameter settings.

2. Trolley Drives

Provide trolley complete with a drive arrangement with a minimum of two wheels driven by an integral electric motor. Drive mechanism must run in totally enclosed oil bath. Limit switches are optional for drive mechanism. Acceleration and deceleration controls must meet requirements specified in this section.

B. Load Block and Hook Assembly

Construct the load block of steel. Provide an unpainted single barbed forged steel hook complying with ASTM A668/A668M. Hook dimensions must be as shown on the drawings. Fit hook with safety latches designed to preclude inadvertent displacement of slings from the hook saddle. Provide hook nut with a removable type set screw or other similar fastener, installed in a plane parallel to the longitudinal axis of the hook shank. Do not weld hook nut. Hook must be free to rotate through 360 degrees when supporting the test load up to 131.25 percent of the rated capacity. Provide only hooks which are designed and commercially rated in accordance with CMAA and conforming to CMAA 74

C. Hoisting Ropes

Wire ropes must conform to ASTM A1023/A1023M and be tested as required by ASTM A931. Provide 6 by 37 class construction hoisting ropes, with improved or extra improved plow steel, as a minimum, and an independent wire rope core. Maximum hoisting rope fleet angles must be 4 degrees for drums and 4.75 degrees for sheaves. Hoisting rope end connections, other than drum connections, must be splattered sockets with forged steel terminals or swaged fittings installed in a fashion that provides 100 percent of the breaking strength of the wire rope. Provide proof of wire rope breaking strength. Wedge sockets or aluminum swages are not permitted on wire rope end connections.

D. 2.3.4 Sheaves

Provide steel sheaves. Minimum pitch diameters must be 18 times the rope diameter for running sheaves, and 12 times the rope diameter for equalizer sheaves. Sheave surfaces which contact wire rope are not to be painted.

E. Hoist Drum

Provide drum made of steel. Design drum so that not less than two dead wraps of hoisting rope remain on each anchorage when the hook is in its extreme low position. Drum grooving must be right and left hand beginning at the ends and grooving toward the center of the drum. Minimum drum groove depth, must be 0.375 times the rope diameter. Minimum drum groove pitch must be either 1.14 times the rope diameter, or the rope diameter plus 1/8 inch, whichever is smaller. Minimum drum pitch diameter must be 18 times the rope diameter. Do not paint, coat, or galvanize the surface of the drum which comes in contact with wire rope.

For wire rope drums installed directly onto the output shaft of the hoist speed reducer without an intermediate flexible coupling, the drum to shaft connection must be a barrel coupling.

F. Gearing

Provide gearing of the enclosed gear reducers type. Provide spur, helical, or herringbone type gears and pinions only, forged, cast or rolled steel. Open-type gearing is not acceptable, except for final drives. Gears and pinions must have adequate strength and durability for the crane service class and be manufactured to ANSI/AGMA 2001 Quality Class 6 or better precision per AGMA ISO 10064-6.

G. Gear Reducers

Gear reducers must be standard items of manufacturers regularly engaged in the design and manufacture of gear reducers for integral components of standard hoists or hoist/trolley units of manufacturers regularly engaged in the design and manufacture of hoists or hoist/trolley units for Class C cranes. Gear reducers must be designed, manufactured and rated for trolley drives only, as applicable. Except for final reduction, the gear reduction units must be fully enclosed in oil-tight housing. Gearing must be designed to AGMA standards and operate in an oil bath. Operation must be smooth and quiet.

H. Open Gearing

Provide all gears and pinions with adequate strength and durability for the crane service class C and manufactured to ANSI/AGMA 2001 quality class 6 or better precision per AGMA ISO 10064-6. Open gears must be enclosed with safety guards provided with openings with covers for inspection and access for grease lubrication.

I. Wheels

Provide bridge travel wheels of rolled-to-shape wrought or forged steel. Rim toughen wheels to not less than 320 Brinell Hardness Number (BHN). Wheel sizing and flange-to-rail head clearances must be in accordance with CMAA 74 recommendations.

J. Bridge and Trolley Brakes

Provide bridge and trolley drives with electro-mechanical brakes capable of stopping the motion of the bridge or trolley within a distance in feet equal to 10 percent of the full load speed in feet per minute when traveling at full speed with a full load.

Provide trolley braking system with spring-applied and electrically-released shoe, disc, or conical brakes. Braking system must be automatically set when controls are released or power

is interrupted. Provisions must be made to facilitate easy brake adjustment. Brakes must have a torque rating of at least 50 percent of trolley drive motor rated torque.

K. Hoist Brakes

Provide hoist holding brake that is an electrically opened, mechanically closed unit. Provide shoe brake, disc brake or conical brake type having a minimum torque rating of 200% of motor full load torque.

L. Bumpers

Provide bumpers on the bridge and trolley per CMAA 74 guidelines.

M. End Trucks

Configure bridge and trolley trucks with a feature that limits load movement to 1" in the event of wheel or shaft failure.

2.4 ELECTRICAL COMPONENTS

A. Motors

Motors must meet all applicable requirements of NEMA MG 1 and UL 1004-1. Provide insulated inverter duty motors for Variable Frequency Drives (VFD). Motor insulation must be Class H, but with a Class B temperature rise. Provide two speed, AC squirrel cage induction type motor with soft start for the hoist. Provide Class F motor insulation for motors with magnetic controls. Provide motor overload protection utilizing a thermal sensitive device embedded in its windings.

B. Controls

Provide static reversing, adjustable frequency controllers for the bridge and trolley electric drives. Provide dynamic braking for all electric drives. Speed control may be two step or stepless infinitely variable type for the hoist function and must be stepless infinitely variable type for the bridge and trolley functions. The hoist, trolley and bridge brakes must set only after the associated controller decelerates the motor to a controlled stop. All motors must run smoothly, without torque pulsations at the lowest speed and be energized at a frequency not exceeding 120 HZ at the highest speed.

Provide two-speed magnetic controls for the hoist drive. Ensure that an energized drive motor initially rotates only in the direction selected by the operator by activating the corresponding direction; i.e., is not overhauled.

Feed control circuits from a single phase, air cooled, double wound transformer with a grounded metal screen between the primary and secondary windings of the transformer

C. Protection

Protection must not be less than that required by NEMA ICS 3, NEMA ICS 8, CMAA 74, NFPA 70, UL 1004-1, UL 1449, UL 489, UL 50, UL 943, 29 CFR 1910.147, 29 CFR 1910.179, 29 CFR 1910.306 and all applicable provisions of 29 CFR 1910. Provide enclosed type circuit

breaker readily accessible to the crane operator for crane disconnect. Provide an On/Off button that removes power from the motors, brakes and control circuit on the operator's control pendant station or radio controller. Provide for lockout/tagout of all hazardous energy sources.

D. Reactors

Provide line reactors rated for continuous duty operation based upon the motor nameplate amperes. Select reactors for 60 Hz operation and having taps for field adjustment of inductance so as to permit achievement of the optimum acceleration characteristics for the drive. For a drive motor branch circuit that exceeds 100 feet in length, the reactor must also be connected in series with the controller load (output) terminals to provide standing wave protection.

E. Limit Switches

Provide primary upper and lower geared limit switches. Geared limits must allow reversing direction to back out of the limit without resetting. Provide a backup mechanical hook block activated upper limit switch wired independent of the directional controllers and the primary upper limit switch that removes power from the hoist motor, hoist brake and hoist controls conforming to UL 1449. The backup limit must require hoist resetting prior to operation of the hoist in any direction.

F. Pendant Pushbutton Station

Suspend the pendant pushbutton station from an independent festooned messenger track system, operating the length of the bridge. Locate the pendant pushbutton station 4 feet above the finished floor. Clearly mark all controls for identification of functions. Provide directional contactors with both mechanical and electrical interlocks.

G. Bridge and Runway Electrification

Provide festooned type or enclosed safety bar type bridge electrification. Provide enclosed safety bar type runway electrification. Power collectors must be a fully redundant dual shoe.

H. Overload Protection

Provide overload protection for bridge, runway, and hoist systems. Hoist overload protection must be adjustable between 80 and 110 percent of hoist capacity.

I. Warning Devices

Provide a warning horn that is operable from a push button at the pendant pushbutton station. Provide a warning strobe that is illuminated at all times during movement of the hoist, trolley, or bridge function.

2.5 ENCLOSURES

A. Provide enclosures for control panels, controls, and brakes in accordance with NEMA 250 and NEMA ICS 6.

- B. Provide a non-resettable hour meter, connected across the main line contactor, readable from the exterior of the main control panel, to indicate the elapsed number of hours the crane is energized.

2.6 CRANE PAINTING

- A. Paint exposed portions of the crane and girders in accordance with Section 099123 "Interior Painting."
- B. CMAA 74. Desired color is brilliant yellow.
- C. Coat faying surfaces of bolted connections per AISC 325, but do not apply finish paint.
- D. Paint the load block brilliant yellow with black diagonal striping, one inch wide diagonal black stripes located on 2-inch centers.
- E. Factory paint electrical and mechanical equipment in accordance with the manufacturer's best standard practice (for the specified environment), except that electrical equipment doors, which expose current-carrying electrical conductors when opened, must be orange.

2.7 IDENTIFICATION PLATES

- A. Furnish and install identification plates. Provide non-corrosive metal identification plates with clearly legible permanent lettering giving the manufacturer's name, model number, serial number, capacity in both kilogram and pound units printed in different colors, and other essential information or identification.
- B. Markings on Crane, Trolley, and Hook

Markings include: bridge motion direction arrows on both sides of the bridge; and trolley motion direction arrows on both sides of trolley. Markings must be visible from push button station and from the loading point, corresponding to the push button labeling on the pendant pushbutton station. Mark the hook rated capacity in tons on both sides of the hoist load block.

2.8 RUNWAY SYSTEM AND CRANE RAIL

- A. Provide structural steel and crane rail as required to accommodate the crane as specified in this section and as required to be fully supported by the structure indicated and specified in Sections 13 34 19 METAL BUILDING SYSTEMS and is not within the scope of this section.

PART 3 - EXECUTION

3.1 ERECTION AND INSTALLATION

- A. Erect and install the crane, complete in accordance with the approved submittals and in condition to perform the operational and acceptance tests.

3.2 ERECTION SERVICES

- A. The crane manufacturer must provide supervisory erection services.

3.3 FIELD QUALITY CONTROL

- A. Post-Erection Inspection.

After erection, the Contractor and the Contracting Officer must jointly inspect the crane bridge and hoist systems and components to determine compliance with specifications and approved submittals. Notify the Contracting Officer 10 days before the inspection. Provide a report of the inspection indicating the crane is considered ready for operational tests.

- B. Operational Tests

Check the clearance envelope of the entire crane prior to picking or traversing any load to ensure there are no obstructions. Test the systems in service to determine that each component of the system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacture, installation, and workmanship. Rectify all deficiencies disclosed by testing and retest the system or component to prove the crane is operational. The Contractor must furnish test loads, operating personnel, instruments, and other apparatus necessary to conduct field tests on each crane.

- C. Test Data

Record test data on appropriate test record forms suitable for retention for the life of the crane. Record operating and startup current measurements for electrical equipment (motors and coils) using appropriate instrumentation (i.e., clamp-on ammeters). Compare recorded values with design specifications or manufacturer's recommended values; abnormal differences (i.e., greater than 10 percent from manufacturer's or design values) must be justified or appropriate adjustments performed. In addition, note, investigate, and correct any high temperatures or abnormal operation of any equipment or machinery. Record hoist, trolley, and bridge speeds during each test cycle.

- D. No-Load Test

Raise and lower the hook through the full range of normal travel at rated speed for three complete cycles. Raise and lower the hook, testing other speeds of the crane. Verify proper operation of hoist limit switches. Operate the bridge and trolley in each direction the full distance between end stops. Operate through the entire speed range and verify proper brake operation.

- E. Load Tests

Perform the following tests, as specified, with test loads of 100 percent (plus 0 minus 10) or 125 percent (plus 5 minus 0) of rated load.

1. Static Load Test 125 percent only): Check entire structure, holding brake and hoisting components as follows: With the trolley in the center of the bridge span, raise the test load approximately one foot. Hold the load for 10 minutes. Rotate the load and hook

360 degrees to check bearing operation with no binding. Observe lowering that may occur which indicates a weakness in the structure or malfunction of hoisting components or brakes. Verify that maximum beam and girder deflections do not exceed CMAA 74 design limits.

2. Raise and lower and test load through the full lift range. Lower the load to the floor, wait 5 minutes, then raise and lower the load through two more cycles. Operate continuously for a minimum of 5 minutes. As a minimum, operate in each speed for each test load. In addition, the dynamic test of test load sequence number 2 (125 percent of rated load) must be repeated for 10 cycles at rated speed, in order to demonstrate proper operation and repeatability of all functions without component overheating or malfunction. Completely stop the machinery at least once in each direction during each cycle to ensure proper brake operation. Do not stop hoist for more than 15 seconds prior to commencing the next cycle.
3. Hoist Load Brake (125 percent only): Raise test load approximately 5 feet. With the hoist controller in the neutral position, release (by hand) the holding brake. Document the method used to release the holding brake. The load brake must hold the test load. Again, with the holding brake in the released position start the test load down (first point) and return the controller to the "off" position as the test load lowers. The load brake must stop and hold the test load.
4. Hoist Loss of Power Test 125 percent only: Raise the test load to approximately 8 feet. While slowly lowering the test load (first point), disconnect the crane's power source. Verify that the test load does not lower and that the brake is set

F. Trolley

Operate the trolley the full distance of the bridge rails in each direction with a test load of 125 percent of rated load on the hook (one cycle). Check proper functioning of all drive speed control points. Verify proper brake action.

G. Bridge

With a test load of 125 percent of rated load on the hook, operate the bridge for the full length of the runway in one direction with the trolley at the extreme end of the bridge, and in the opposite direction with the trolley at the opposite extreme end of the bridge (one cycle). Check proper functioning of all drive speed control points. Check for any binding of the bridge end trucks and verify proper brake action. Record deficiencies. Secure from testing if deficiencies are found.

H. Rated Travel Tests

Repeat travel tests for trolley and bridge with a test load of 100 percent of rated load. Repeat the test for 5 cycles at rated speed to demonstrate proper operation and repeatability of all functions without the overheating or malfunction of any components. Completely stop the machinery at least once in each direction during each cycle to ensure proper brake action. Do not stop machinery for more than 15 seconds prior to commencing the next cycle.

I. Trolley Loss of Power Test

With a test load of 100 percent of rated load, raise the test load approximately midway between the trolley and any permanent obstruction on the operating floor. Starting at a safe distance from walls or other obstructions, attain a slow speed (first point) of trolley travel. While maintaining a safe distance from obstructions, disconnect the main power source at the wall mounted safety switch (disconnect) to simulate a power failure. Verify that the trolley stops and that the brake sets properly. Measure the distance required for the trolley to stop.

J. Bridge Loss of Power Test

With a test load of 100 percent of rated load, raise the test load approximately midway between the trolley and any permanent obstruction on the operating floor. Starting at a safe distance from walls or other obstructions, attain a slow speed (first point) of bridge travel. While maintaining a safe distance from obstructions, disconnect the main power source at the wall mounted safety switch (disconnect) to simulate a power failure. Verify that the bridge stops and that the brake sets properly. Measure the distance required for the bridge to stop.

END OF SECTION 412213