

# CITY OF LAREDO UTILITIES DEPARTMENT

City of Laredo, Texas • 5816 Daugherty  
Laredo, Texas 78041



## PROJECT MANUAL CONTRACT DOCUMENTS

### SOUTH LAREDO WASTEWATER TREATMENT PLANT BLOWER BUILDING ENCLOSURE PROJECT

November 2024

PREPARED BY:



Texas TBPE Firm Registration No. F-3043  
11490 Westheimer Road, Suite 700 • Houston, Texas 77077  
Tel (713) 423-7300  
[www.cdmsmith.com](http://www.cdmsmith.com)



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DOCUMENT 000107 - SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. Engineer:



1. Christopher Varnon.
2. License PE #97453.
3. Responsible for Division 01.

B. Architect:



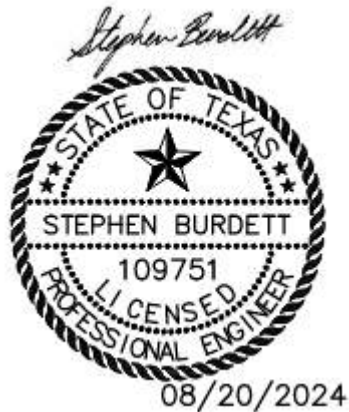
1. Charlotte Throop.
2. License #5301.
3. Responsible for Division 04, Division 07, Division 08.

C. Structural Engineer:



1. Ivan G. Salva.
2. License PE #107704.
3. Responsible for Division 03 Sections, Division 05

D. Plumbing and HVAC Engineer:



1. Stephen M. Burdett.
2. License PE #109751.
3. Responsible for Division 15.

E. Electrical Engineer:



1. Brian G. Byrd.
2. License PE #107182.
3. Responsible for Division 16.

F. Instrumentation and Controls Engineer:



1. Anjali Paithankar.
2. License PE #121554.
3. Responsible for Division 13.

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## TABLE OF CONTENTS

<b>DIVISION A</b>	<b>Page(s)</b>
Invitation to Bidders .....	ITB-1 thru ITB-2
Notice to Bidders .....	NTB-1 thru NTB-3
Information to Bidders .....	IB-1 thru IB-4
Advice to Bidders .....	AB-1
Important Information to Contractors .....	IC-1 thru IC-3
Proposal and Affidavit .....	PA-1 thru PA-13
Bid Bond .....	BB-1
Checklist for Bidders .....	CB-1 thru CB-2
Construction Contract .....	CC-1 thru CC-2
Performance Bond and Payment Bond .....	PPB-1 thru PPB-6
Certificate of Owner’s Attorney .....	COA-1
Contractor’s and Subcontractor’s Insurance .....	CI-1 thru CI-14
<b>DIVISION B</b>	
Contract Time and Liquidated Damages .....	CT-1
Equal Opportunity Clause .....	EOC-1 thru EOC-2
Prevailing Wages .....	PW-1
Wage Rates .....	1 thru 10
Inspection by City .....	IBC-1
Project Sign .....	PS-1 thru PS-2
Illegal Dumping .....	ID-1
<b>DIVISION C</b>	
Definition of Terms .....	DT-1 thru DT-2
Definition of Abbreviations .....	DA-1 thru DA-2
Instructions to Bidders .....	IB-1 thru IB-3
Award and Execution of Contract .....	AEC-1 thru AEC-2
Scope of Work .....	SW-1 thru SW-2
Control of Work and Materials .....	CWM-1 thru CWM-6
Legal Relations and Responsibilities to the Public .....	LRRP-1 thru LRRP-3
Prosecution and Progress .....	PP-1 thru PP-3
Measurement and Payment .....	MP-1 thru MP-6
<b>DIVISION D – SPECIAL CONTRACT CONDITIONS</b>	
Contract Conditions .....	CT-1 thru CT-7
00630 Construction Maintenance Bond	
00840 Contractor Affidavit for Partial Payment	
00850 Certification of Completion (By Contractor)	
00855 Certification of Completion (By Subcontractor)	

**DIVISION 1 - GENERAL REQUIREMENTS**

01010	SUMMARY
01011	SITE CONDITIONS
01110	ENVIRONMENTAL PROTECTION PROCEDURES
01170	SPECIAL PROVISIONS
01250	SUBSTITUTION PROCEDURES
01260	CONTRACT MODIFICATION PROCEDURES
01290	PAYMENT PROCEDURES
01310	PROJECT MANAGEMENT AND COORDINATION
01320	CONSTRUCTION PROGRESS DOCUMENTATION
01323	PHOTOGRAPHIC DOCUMENTATION
01330	SUBMITTAL PROCEDURES
01400	QUALITY REQUIREMENTS
01420	REFERENCES
01500	TEMPORARY FACILITIES AND CONTROLS
01600	PRODUCT REQUIREMENTS
01730	EXECUTION
01740	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
01770	CLOSEOUT PROCEDURES
01782	OPERATION AND MAINTENANCE DATA
01783	PROJECT RECORD DOCUMENTS
01790	DEMONSTRATION AND TRAINING
01910	GENERAL COMMISSIONING REQUIREMENTS

**DIVISION 3 - CONCRETE**

03015	MODIFICATIONS TO EXISTING CONCRETE
03150	CONCRETE JOINTS AND ACCESSORIES
03303	MISCELLANEOUS CAST-IN-PLACE CONCRETE
03600	GROUTING

**DIVISION 4 MASONRY**

04220	CONCRETE UNIT MASONRY
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**DIVISION 5 - METALS**

05051	POST-INSTALLED ANCHORS AND REINFORCING BARS
05502	METAL FABRICATIONS

**DIVISION 7 - THERMAL AND MOISTURE PROTECTION**

06100	ROUGH CARPENTRY
07210	THERMAL INSULATION
07273	FLUID-APPLIED MEMBRANE AIR BARRIERS
07421	FORMED METAL WALL PANELS
07423	INSULATED METAL WALL PANELS
07710	ROOF SPECIALTIES
07920	JOINT SEALANTS



**DIVISION 8 - DOORS AND WINDOWS**

- 08113 HOLLOW METAL DOORS AND FRAMES
- 08710 DOOR HARDWARE
- 08919 FIXED LOUVERS
- 09912 INTERIOR PAINTING

**DIVISION 13 - SPECIAL CONSTRUCTION**

- 13610 PROCESS CONTROL AND ENTERPRISE MANAGEMENT SYSTEMS GENERAL PROVISIONS
- 13612 PROCESS CONTROL SYSTEM TESTING
- 13613 PROCESS CONTROL SYSTEM TRAINING
- 13614 PROCESS CONTROL DESCRIPTIONS

**DIVISION 15 - MECHANICAL**

- 15042 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
- 15061 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
- 15091 DUCT INSULATION
- 15712 METAL DUCTS
- 15715 AIR DUCT ACCESSORIES
- 15724 HVAC POWER VENTILATORS
- 15806 PACKAGED TERMINAL AIR-CONDITIONERS, OUTDOOR, WALL-MOUNTED UNITS
- 15905 TESTING, ADJUSTING, AND BALANCING FOR HVAC
- 15933 PRESSURE INSTRUMENTS
- 15935 TEMPERATURE INSTRUMENTS

**DIVISION 16 - ELECTRICAL**

- 16011 FACILITY PERFORMANCE REQUIREMENTS FOR ELECTRICAL
- 16050 LIMITED ELECTRICAL FOR SMALL PROJECTS

END OF TABLE OF CONTENTS

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## INVITATION TO BIDDERS

Sealed bids will be received at **City Secretary's Office, 1110 Houston Street, 3<sup>rd</sup> floor, City Hall Building, Laredo, Texas, and shall be date and time stamped before 4:00 P.M. on December 5, 2024, then publicly opened the following day at 10:00 am on December 6, 2024** and read, and taken under advisement for the furnishing of all necessary materials, machinery, equipment, labor, superintendence, and all other services and things required for certain wastewater system improvements for the City of Laredo. Said bid shall be marked,

**“South Laredo Wastewater Treatment Plant Blower Building Enclosure Project”**

**The project generally consists of providing all labor, tools, equipment and materials necessary to make modifications to the South Laredo WWTP Blower Building to enclose the blower rooms, provide HVAC improvements, modify the blower process air intakes, cooling air intakes, and cabinet cooling exhaust, and other Work indicated in the Contract Documents.**

Each proposal and the proposal guaranty must be originals and must be sealed in an envelope plainly marked with the name of the project as shown above, and the name and address of the Bidder. When submitted by mail, this envelope shall be placed in another envelope addressed as indicated in this Notice to Bidders.

Only proposals and proposal guaranties actually in the hands of the designated official at the time set in this Notice to Bidders shall be considered. Proposals submitted by telephone, telegraph, or fax will not be considered.

Bidders are expressly advised to review Section C-3.10 of the General Conditions of the proposed Contract as to the causes which may lead to the disqualification of a bidder and/or the rejection of a bid proposal. Unless all bids are rejected, Owner agrees to give Notice of Award of Contract to the successful bidder within ninety (90) days after the date of the bid opening.

Bidders are expected to inspect the site of the work and inform themselves regarding all local conditions.

**A non-mandatory Virtual Pre-Bid Conference with prospective bidders will be held November 14, 2024, at 10:00 A.M.**

**Pre-bid site visit will be on appointment basis with Mr. Tomas Hernandez (965) 795-2720. The site address is at the South Laredo Wastewater Treatment Plant, 309 River Front, Laredo, TX 78046.**

This contract is contingent upon release of funds from the Texas Water Development Board. Any contract(s) awarded under this Invitation for Bids is/are expected to be funded in part by a loan or grant from the Texas Water Development Board and a grant from the United States Environmental Protection Agency, U.S. EPA. Neither the State of Texas, the U.S. EPA, nor any of its departments, agencies, or employees, are or will be a party to this Invitation for Bids or any resulting contract.

Copies of the plans and specifications may be reviewed and downloaded from City website at: <https://www.cityoflaredo.com/departments/purchasing-division/bids>

For information concerning the proposed work, prospective bidders shall submit Request for Bid Information to Jerry Garza, City of Laredo Water/Wastewater Utility Department.

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Jose A. Valdez Jr. - City Secretary

Publication Dates:  
November 3, 2024  
November 10, 2024

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**NOTICE TO BIDDERS**

Sealed bids shall be hand delivered and received at **City Secretary's Office, 1110 Houston Street, 3<sup>rd</sup> floor, City Hall Building, Laredo, Texas, and shall be date and time stamped before 4:00 P.M. on December 5, 2024 then publicly opened the following day at 10:00 A.M. on December 6, 2024** and read, and taken under advisement for the furnishing of all necessary materials, machinery, equipment, labor, superintendence, and all other services and things required for certain wastewater system improvements for the City of Laredo. Said bid shall be marked,

**"South Laredo Wastewater Treatment Blower Building Enclosure Project"**

**The project generally consists of providing all labor, tools, equipment and materials necessary to make modifications to the South Laredo WWTP Blower Building to enclose the blower rooms, provide HVAC improvements, modify the blower process air intakes, cooling air intakes, and cabinet cooling exhaust, and other Work indicated in the Contract Documents.**

Each proposal and the proposal guaranty must be originals and must be sealed in an envelope plainly marked with the name of the project as shown above, with the name and address of the Bidder. When submitted by mail, this envelope shall be placed in another envelope addressed as indicated in this Notice to Bidders.

Only proposals and proposal guaranties actually in the hands of the designated official at the time set in this Notice to Bidders shall be considered. Proposals submitted by telephone, telegraph, or fax will not be considered.

**Instructions to Bidder Conditions****1. DISADVANTAGED BUSINESS ENTERPRISE GOALS**

This contract is subject to the Environmental Protection Agency's (EPA) "fair share policy", which includes EPA-approved "fair share goals" for Minority Business Enterprise (MBE) and Women Business Enterprise (WBE) firms in the Construction, Supplies, Equipment, and Services procurement categories. EPA's policy requires that applicants and prime contractors make a good faith effort to award a fair share of contracts, subcontracts, and procurements to Minority Business Enterprise and Women-Owned Business Enterprise firms. Although EPA's policy does not mandate that the fair share goals be achieved, it does require applicants and prime contractors to demonstrate use of the six affirmative steps. The current fair share goals for the State of Texas are as follows:

<b>CATEGORY</b>	<b>MBE</b>	<b>WBE</b>
CONSTRUCTION	12.94%	8.72%
EQUIPMENT	7.12%	5.39%
SERVICES	10.84%	5.72%
SUPPLIES	9.68%	9.34%

**2. EQUAL EMPLOYMENT OPPORTUNITY AND AFFIRMATIVE ACTION**

All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age, handicap or national origin. Bidders on this work will be required to comply with the President's Executive Order No. 11246 as amended by Executive Order 11375, and as supplemented in Department of Labor regulations 41 CFR Part 60.

**3. DEBARMENT AND SUSPENSION CERTIFICATION**

This contract is subject to the provisions the Federal Debarment and Suspension requirements of 2CFR Part 1532.220 and 1532.332.

**4. BID GUARANTY**

Each bidder shall furnish a bid guaranty equivalent to five percent of the bid price. (Water Code 17.183). If a bid bond is provided, the contractor shall utilize a surety company which is authorized to do business in Texas in accordance with Art.7.19-1. Bond of Surety Company; Chapter 7 of the Insurance Code.

**5. AWARD OF CONTRACT TO NONRESIDENT BIDDER**

A governmental entity may not award a governmental contract to a nonresident bidder unless the nonresident underbids the lowest bid submitted by a responsible resident bidder by an amount that is not less than the amount by which a resident bidder would be required to underbid the nonresident bidder to obtain a comparable contract in the state in which the nonresident's principal place of business is located. A non-resident bidder is a contractor whose corporate offices or principal place of business is outside of the state of Texas. (Source: Texas Government Code Chapter 2252 Subchapter A Nonresident Bidders, (§ 2252.002.)

Bidders are expressly advised to review the General Conditions of the proposed Contract as to the causes which may lead to the disqualification of a bidder and/or the rejection of a bid proposal. Unless all bids are rejected, Owner agrees to give Notice of Award of Contract to the successful bidder within ninety (90) days after the date of the bid opening or for such longer period of time that Bidder may agree to in writing upon request of Owner.

Bidders are expected to inspect the site of the work and inform themselves regarding all local conditions.

**A non-mandatory Virtual Pre-Bid Conference with prospective bidders will be held November 14, 2024, at 10:00 A.M.**

**Pre-bid site visit will be on appointment basis with Mr. Tomas Hernandez (956) 721-2022. The site address is at the South Laredo Wastewater Treatment Plant, 309 River Front, Laredo, TX 78046.**

Copies of the plans and specifications may be reviewed and downloaded from City website at: <https://www.cityoflaredo.com/departments/purchasing-division/bids>

**TEXAS ETHICS COMMISSION HOUSE BILL 1295 DISCLOSURE REQUIREMENTS**

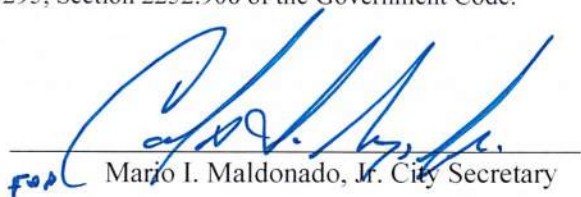
The City may not accept this bid until it has received from the bidder a completed, signed, and notarized TEC Form 1295 complete with a certificate number assigned by the Texas Ethics Commission ("TEC"), pursuant to Texas Government Code § 2252.908 and the rules promulgated thereunder by the TEC. The undersigned understands that failure to provide said form complete with a certificate number assigned by the TEC will result in a non-conforming bid and will prohibit the City from considering this bid for acceptance.

Provision of Texas Ethics Commission Form 1295 ("TEC Form 1295") by Bidders: Effective January 1, 2016, pursuant to Texas Government Code § 2252.908 (the "Interested Party Disclosure Act" or the "Act"), the City may not award the contract to a bidder unless the bidder has provided to the City a completed, signed and notarized TEC Form 1295 which has been assigned a certificate number by the Texas Ethics Commission (the "TEC"). Pursuant to the rules prescribed by the TEC, the TEC Form 1295 must be completed online through the TEC's website, assigned a certificate number, printed, signed and notarized, and provided to the City. The TEC Form 1295 may accompany the bid or may be submitted separately, but must be provided to the City prior to the award of the contract. For purposes of completing the TEC Form 1295, the entity's name is City of Laredo; the contract ID number is 2517-96098; and the description of goods and services is South Laredo Wastewater Treatment Plant 12 MGD to 18 MGD Expansion Belt Filter Presses Replacement Project. Neither the City nor its Engineer have the ability to verify the information included in a TEC Form 1295, and neither have an obligation nor undertake responsibility for advising any bidder with respect to the proper completion of the TEC Form 1295.

See Attachment A – Texas Ethics Commission Houston Bill 1295, Section 2252.908 of the Government Code.

**Publication Dates:**

November 3, 2024  
November 10, 2024

  
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Mario I. Maldonado, Jr. City Secretary

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**TEXAS ETHICS COMMISSION****OVERVIEW**

In 2015, the Texas Legislature adopted House Bill 1295, which added Section 2252.908 of the Government Code. The law states that a governmental entity or state agency may not enter into certain contracts with a business entity unless the business entity submits a disclosure of interested parties to the governmental entity or state agency at the time the business entity submits the signed contract to the governmental entity or state agency. The law applies only to a contract of a governmental entity or state agency that either (1) requires an action or vote by the governing body of the entity or agency before the contract may be signed or (2) has a value of at least \$1 million. The disclosure requirement applies to a contract entered into on or after January 1, 2016.

The Texas Ethics Commission was required to adopt rules necessary to implement that law, prescribe the disclosure of interested parties form, and post a copy of the form on the Commission's website. (See attached Rules.) The Commission adopted the Certificate of Interested Parties form (Form 1295) on October 5, 2015. The Commission also adopted new rules (Chapter 46) on November 30, 2015, to implement the law.

**Filing Process:**

By January 1, 2016, the commission will make available on its website a new filing application that must be used to file Form 1295. A business entity must use the application to enter the required information on Form 1295 and print a copy of the completed form, which will include a certification of filing that will contain a unique certification number. An authorized agent of the business entity must sign the printed copy of the form and have the form notarized. The completed Form 1295 with the certification of filing must be filed with the governmental body or state agency with which the business entity is entering into the contract.

The governmental entity or state agency must notify the commission, using the commission's filing application, of the receipt of the filed Form 1295 with the certification of filing not later than the 30th day after the date the contract binds all parties to the contract. The commission will post the completed Form 1295 to its website within seven business days after receiving notice from the governmental entity or state agency.

Information regarding how to use the filing application will be available on this site by January 1, 2016.

**FREQUENTLY ASKED QUESTIONS FOR DISCLOSURE OF INTERESTED PARTIES (FORM 1295)****1. WHO IS REQUIRED TO FILE FORM 1295?**

In 2015, the Texas Legislature adopted House Bill 1295, which added section 2252.908 of the Government Code. The law states that a governmental entity or state agency may not enter into certain contracts with a business entity unless the business entity submits a disclosure of interested parties (Form 1295) to the governmental entity or state agency at the time the business entity submits the signed contract to the

governmental entity or state agency. The Texas Ethics Commission has adopted rules requiring the business entity to file Form 1295 electronically with the Commission.

## **2. WHAT CONTRACTS DOES FORM 1295 APPLY TO?**

The law applies only to a contract of a governmental entity or state agency that either:

- (1) requires an action or vote by the governing body of the entity or agency before the contract may be signed; or
- (2) has a value of at least \$1 million.

Gov't Code § 2252.908. The disclosure requirement applies to a contract entered into on or after January 1, 2016.

A contract does not require an action or vote by the governing body of a governmental entity or state agency if:

- (1) the governing body has legal authority to delegate to its staff the authority to execute the contract;
- (2) the governing body has delegated to its staff the authority to execute the contract; and
- (3) the governing body does not participate in the selection of the business entity with which the contract is entered into.

1 T.A.C. § 46.1(c).

## **3. CAN I FILE FORM 1295 ON PAPER?**

No. A business entity must file Form 1295 electronically with the Texas Ethics Commission using the online filing application. See Question #4 for information about logging in to the online filing application.

## **4. HOW DO I LOGIN TO THE FILING APPLICATION?**

If this is your first time logging in, you will need to create an account in order to register and receive a password. Once you have registered, you will receive an email containing a password setup link. Click on the link to set your password. After you have established an account, you will use your email address, password, and user type (either "Business Entity" or "Governmental Entity/State Agency") to log in to the filing application. Watch our short videos on "Logging In The First Time" on the Form 1295 File Reports Electronically web page.

## **5. IS THERE A MOBILE VERSION?**

The mobile version is not complete at this time, but will be available soon.

## **6. HELP! I FORGOT MY PASSWORD.**

If you forgot your password, you can reset your password by clicking the "Forgot Password?" link on the filing application login screen. Once you enter your email address and filer type and successfully answer the security questions, you will receive an email containing a password reset link. If you cannot successfully answer your security questions, you will need to call the Texas Ethics Commission at (512)463-5800.



**7. CAN I HAVE MULTIPLE ACCOUNTS?**

You can have a separate account associated with each unique email address. However, once an account is established, there is no way to combine it with another account. You can only view those certificates created under your own unique email address. If you want to view all your certificates together in one account, we highly encourage you to setup a specific email address to register your account and use that email address each time you login to the filing application.

**8. HOW MUCH TIME DO I HAVE TO ACKNOWLEDGE A FORM 1295?**

A state agency or other governmental entity must acknowledge the receipt of the filed Form 1295 not later than the 30th day after the date the contract binds all parties to the contract. Once a Form 1295 is acknowledged, it will be posted to the Texas Ethics Commission's website within seven business days.

**9. DO I SEND A COPY OF THE NOTARIZED FORM 1295 TO THE TEXAS ETHICS COMMISSION?**

No. Do not send a paper copy of the notarized Form 1295 to the Texas Ethics Commission. If you are with a state agency or other governmental entity, you will login to the filing application and acknowledge receipt of Form 1295 electronically. See Question #4 for more information about logging into the filing application.

**10. WHAT IF I ACCIDENTALLY ACKNOWLEDGE THE WRONG FORM 1295?**

Before you acknowledge a Form 1295, you should double check that you are acknowledging the correct one. If you acknowledge a Form 1295 in error, you cannot undo the certification. Contact the Texas Ethics Commission at 512-463-5800 and ask to speak with Technical Support.

**11. THE FILING APPLICATION SAYS THIS FORM 1295 HAS ALREADY BEEN ACKNOWLEDGED. WHAT DO I DO NOW?**

First, you should double check that you are entering the correct certification number. If you still receive an error, contact the Texas Ethics Commission at 512-463-5800 and ask to speak to technical support.

**12. I SUBMITTED A FORM 1295 AND REALIZED THERE IS AN ERROR. CAN I STILL EDIT IT?**

No. Once a Form 1295 has been submitted by the business entity, it can no longer be edited. If you found an error, you will need to start a new certificate and re-enter all the required information.

**13. WHAT IF THE CONTRACT ASSOCIATED WITH THE FORM 1295 IS NEVER FULFILLED?**

All certificates that are filed with the Texas Ethics Commission and acknowledged by a governmental entity will be posted to the Commission's website regardless of the eventual outcome of the contract associated with the certificate.

**14. WHY AM I NOT RECEIVING EMAIL MESSAGES FROM THE TEXAS ETHICS COMMISSION?**

All password reset links will be sent to the email address you provided when you registered. This should be an email address that is current and that you check often. You can verify and update your email address

2517-247787

City of Laredo - South Laredo Wastewater Treatment Plant  
Blower Building Enclosure Project

Division A  
**TEXAS ETHICS COMMISSION**

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right after you log in. Also, be sure to “whitelist” or mark as “safe” emails that come from “do-not-reply@ethics.state.tx.us” and be sure to check your Spam or Junk folder for any missing messages.

**TEXAS ADMINISTRATIVE CODE**

**Chapter 46. Disclosure of Interested Parties**  
**(effective December 24, 2015)**  
**Text of Adopted Rule**

**Chapter 46. DISCLOSURE OF INTERESTED PARTIES**

§46.1. Application

(a) This chapter applies to section 2252.908 of the Government Code.

(b) Section 2252.908 of the Government Code applies only to a contract of a governmental entity or state agency entered into after December 31, 2015, that meets either of the following conditions:

- (1) The contract requires an action or vote by the governing body of the entity or agency; or
- (2) The value of the contract is at least \$1 million.

(c) A contract does not require an action or vote by the governing body of a governmental entity or state agency if:

- (1) The governing body has legal authority to delegate to its staff the authority to execute the contract;
- (2) The governing body has delegated to its staff the authority to execute the contract; and
- (3) The governing body does not participate in the selection of the business entity with which the contract is entered into.

§46.3. Definitions

(a) “Contract” includes an amended, extended, or renewed contract.

(b) “Business entity” includes an entity through which business is conducted with a governmental entity or state agency, regardless of whether the entity is a for-profit or nonprofit entity. The term does not include a governmental entity or state agency.

(c) “Controlling interest” means: (1) an ownership interest or participating interest in a business entity by virtue of units, percentage, shares, stock, or otherwise that exceeds 10 percent; (2) membership on the board of directors or other governing body of a business entity of which the board or other governing body is composed of not more than 10 members; or (3) service as an officer of a business entity that has four or fewer officers, or service as one of the four officers most highly compensated by a business entity that has more than four officers.

(d) “Interested party” means: (1) a person who has a controlling interest in a business entity with whom a governmental entity or state agency contracts; or (2) a person who actively participates in facilitating a

contract or negotiating the terms of a contract with a governmental entity or state agency, including a broker, intermediary, adviser, or attorney for the business entity.

(e)“Intermediary,” for purposes of this rule, means, a person who actively participates in the facilitation of the contract or negotiating the contract, including a broker, adviser, attorney, or representative of or agent for the business entity who:

- (1) receives compensation from the business entity for the person’s participation;
- (2) communicates directly with the governmental entity or state agency on behalf of the business entity regarding the contract; and
- (3) is not an employee of the business entity.

#### §46.5. Disclosure of Interested Parties Form

(a) A disclosure of interested parties form required by section 2252.908 of the Government Code must be filed on an electronic form prescribed by the commission that contains the following:

- (1) The name of the business entity filing the form and the city, state, and country of the business entity’s place of business;
- (2) The name of the governmental entity or state agency that is a party to the contract for which the form is being filed;
- (3) The name of each interested party and the city, state, and country of the place of business of each interested party;
- (4) The identification number used by the governmental entity or state agency to track or identify the contract for which the form is being filed and a short description of the goods or services used by the governmental entity or state agency provided under the contract; and
- (5) An indication of whether each interested party has a controlling interest in the business entity, is an intermediary in the contract for which the disclosure is being filed, or both.

**(b) The certification of filing and the completed disclosure of interested parties form generated by the commission’s electronic filing application must be printed, signed by an authorized agent of the contracting business entity, and submitted to the governmental entity or state agency that is the party to the contract for which the form is being filed.**

(c) A governmental entity or state agency that receives a completed disclosure of interested parties form and certification of filing shall notify the commission, in an electronic format prescribed by the commission, of the receipt of those documents not later than the 30th day after the date the contract for which the form was filed binds all parties to the contract.

(d) The commission shall make each disclosure of interested parties form filed with the commission under section 2252.908(f) of the Government Code available to the public on the commission’s Internet website

2517-247787

City of Laredo - South Laredo Wastewater Treatment Plant  
Blower Building Enclosure Project

Division A  
**TEXAS ETHICS COMMISSION**

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not later than the seventh business day after the date the commission receives the notice required under subsection (c) of this section.

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**INFORMATION TO BIDDERS**

Sealed bids will be received at **City Secretary's Office, 1110 Houston Street, 3<sup>rd</sup> Floor, Laredo, Texas and shall be dated and stamped before 4:00 P.M. on December 5, 2024, then publicly opened the following day at 10:00 A.M. on December 6, 2024** and read and taken under advisement for the furnishing of all necessary materials, machinery, equipment, labor, superintendence, and all other services and appurtenances required for the **Wastewater Treatment Plant Blower Building Enclosure Project** in the City of Laredo. Said bids shall be marked

**"South Laredo Wastewater Treatment Plant Blower Building Enclosure Project"**

and shall include acknowledgment of addenda submitted, and all other documents included in said bid call.

Bids shall be based on a per unit of work or lump sum basis and shall include dollar amounts for each specific unit in improvements listed, including those items listed as alternatives, as per the proposal sheet included in the specifications of this project.

Each proposal and the proposal guaranty must be originals and must be sealed in an envelope plainly marked with the name of the project as shown above, and the name and address of the Bidder. When submitted by mail, this envelope shall be placed in another envelope addressed as indicated in this Information to Bidders.

Only proposals and proposal guaranties actually in the hands of the designated official at the time set in this Information to Bidders will be considered. Proposals submitted by telephone or fax will not be considered.

The City reserves the right to award the contract on the basis of the Base Bid and any combination of Alternate Bid items which appears most advantageous to the City, to reject any or all bids, to waive objections based on failure to comply with formalities and to allow the correction of obvious or patent errors. Bidders are expressly advised to review Section C-3 of the General Conditions of the proposed contract as to the causes which may lead to the disqualification of a bidder and/or the rejection of a bid proposal. Unless all bids are rejected, Owner agrees to give Notice of Award of contract to the successful bidder **within ninety (90) days** from the date of the bid opening or for such longer period of time that Bidder may agree to in writing upon request of Owner.

Bidders for the construction work must submit a satisfactory cashier's or certified check, or bidder's bond, payable without recourse to the order of the City of Laredo, Texas, in an amount not less than five percent (5%) of the total bid. Such check or bond shall be submitted as a guarantee that the bidder will enter into a contract and execute performance and payment bonds within ten (10) days after Notice of Award of contract to him for contracts in excess of \$25,000.00. Bids without the required check or bond will NOT be considered.

Successful bidder for the construction of the improvements must furnish a satisfactory Performance Bond in the amount of 100% of the total contract price, and a satisfactory Payment Bond in such amount, both duly executed by such bidder as principal and by a corporate surety duly authorized so to act under the laws of the State of Texas. The successful bidder will be required to provide Performance and Payment Bonds issued by an insurance company which meets the minimum State requirements and is licensed in the State of Texas, and has a Best's Key Rating as follows:

<u>Construction Contract</u>	<u>Rating</u>
\$ 25,001 - 250,000	None
\$ 250,000 - 1,000,000	B
Over \$ 1,000,000	A

All lump sum and unit prices must be stated in both script and figures.

Bidders are expected to inspect the site of the work and to inform themselves regarding all local conditions.

The Instructions to Bidders, Forms of Bid, Form of Contract, Plans, Specifications, Form of Bid Bond, Performance and Payment Bonds and other contractual documents may be examined free of charge at the City of Laredo Water / Wastewater Utility Director, 5816 Daugherty, Laredo, Texas 78041.

Copies of the plans and specifications may be reviewed free of charge at the office of the **City of Laredo Water/ Wastewater Utility Director, 5816 Daugherty, Laredo, Texas 78041.**

Copies of the plans and specifications may be reviewed and downloaded from City website at: [www.cityoflaredo.com/departments/purchasing-division/bids](http://www.cityoflaredo.com/departments/purchasing-division/bids).

**Bid proposals over \$25,000.00 shall comply with all conditions of the bid documents.**

In the event the base bid amount is LESS than \$25,000.00, a Payment Bond and Performance Bond will NOT BE REQUIRED. A Bid Guaranty in the form of a Cashier's or Certified Check or Bid Bond and the Certificate of Insurance, however, WILL BE REQUIRED. Under this condition, the successful bidder for the South Laredo Wastewater Treatment Plant Blower Building Enclosure Project is hereby advised that the total contract price will be paid in ONE PAYMENT upon completion and acceptance of the project by the City of Laredo.

Any other division or section of this project's specifications having reference to Bid Guaranty, Cashier's or Certified Check, Bid Bond, Payment Bond, or Performance Bond, or having mention at all, to the requirements of bonds, is hereby amended to concur with the above conditions ONLY when the base bid is LESS THAN \$25,000.00.

Bidders are advised to contact the Office of the Water / Wastewater Utility Director at 5816 Daugherty, Laredo, Texas, 78044, telephone number (956) 721-2000, for visits to project site, and for any additional information required on the project.

Contractor's attention is directed to Special Provision 000-6233, "Important Notice to Contractors" and "Statement of Materials and Other Charges" which will be included in all projects, beginning with the September 1991 letting. These establish the procedures whereby the Contractor will be permitted to obtain an exemption from the sales tax on certain materials. See Comptroller's Rule 2.291 and Texas Tax Code Chapter 151, as amended by House Bill Number 11, Acts 1991, 72nd Legislature, First called Session. The Contractor will be required to separate the charges for materials from all other charges and will be furnished an Exemption Certificate for each contract with the Department. Also, the Contractor must issue resale certificates to suppliers. Sales tax permit applications and information regarding resale certificates may also be obtained by calling the State Comptroller's toll free number 1-800-252-5555.



The South Laredo Wastewater Treatment Plant Belt Filter Presses Replacement project generally consists of providing all labor, tools, equipment and materials necessary to make modifications to the South Laredo WWTP Blower Building to enclose the blower rooms, provide HVAC improvements, modify the blower process air intakes, cooling air intakes, and cabinet cooling exhaust, and other Work indicated in the Contract Documents.

**A non-mandatory Virtual Pre-Bid Conference with prospective bidders will be held November 14, 2024, at 10:00 A.M.**

**Pre-bid site visit will be on appointment basis with Mr. Tomas Hernandez (956) 721-2022. The site address is at the South Laredo Wastewater Treatment Plant, 309 River Front, Laredo, TX 78046.**

For information concerning the proposed work, prospective bidders shall submit Attachment A to Jerry Garza, City of Laredo Water/Wastewater Utility Department.

Attachment A

REQUEST FOR BID INFORMATION

PROJECT: City of Laredo – South Laredo Wastewater Treatment Plant  
Blower Building Enclosure Project.

TO: City of Laredo Water/Wastewater Utility Department  
5816 Daugherty  
Laredo, Texas 78041

Phone No. (956) 721-2000  
Fax No. (956) 721-2001  
Email Addr. ggarza2@ci.laredo.tx.us

(Type or Print question legibly; use back if more space is needed)

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This request relates to \_\_\_\_\_ and/or \_\_\_\_\_  
Drawing / Detail No. Specification Section No.

Attachments to this request: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Signature  
\_\_\_\_\_  
(Type or Print Name)  
\_\_\_\_\_  
(Type or Print Company Name)

\_\_\_\_\_  
Date

END OF DOCUMENT

**ADVICE TO BIDDERS**

PROJECT: South Laredo Wastewater Treatment Plant Blower Building Enclosure Project

The Contractor's attention is directed to the State of Texas Comptroller of Public Accounts Limited Sales, Excise and Use Tax Rules and Regulations, Paragraph 3 of Ruling No. 9. Repairmen and Contractors (amended April 3, 1972). Reference Article 20.01 (T). Upon compliance within certain conditions this ruling provides for exemption from this tax of materials incorporated into work done for an exempt agency under a Contract. The City is an exempt agency.

Any Bidder may elect to exclude this sales tax from his bid. If the Bidder submitting the lowest acceptable bid for performing the work on this project elects to comply with the above ruling on any bid item included in this Contract by obtaining any necessary permit or permits from the State Comptroller allowing the purchase of material for incorporation into this project without having to pay the Limited Sales, Excise and Use Tax at the time of purchase, he shall upon Award of Contract submit a statement in satisfactory form in which his bid prices to the City for materials are listed separately from all other charges, either by bid item or by total as required by the comptroller. This statement shall be included in and made part of the Contract.

The City will make no further allowance for and will make no price adjustment above or below the originally bid unit price on account of this tax. It shall be the Contractor's sole responsibility, if he elects to exclude the sales tax from his bid, to comply with the aforementioned ruling 9 and with any other applicable rules, regulation, or laws pertaining to the Texas Limited Sales, Excise and Use Tax which may now or at any time during the performance of the Contract be in effect, and the City shall have no responsibility for any sales or use tax which the Contractor may be required to pay as the result of his failure or the City's failure to comply with said rules, regulations, or laws, or as the result of the performance of the Contract or any part thereof by the Contractor.

Bidders are cautioned that materials which are not permanently incorporated into the work are not eligible for exemption and are not to be included in the statements as "Materials" (examples: fuel, lubricants, tools, forming materials, etc.).

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IMPORTANT INFORMATION TO CONTRACTORS

PROJECT: South Laredo Wastewater Treatment Plant Blower Building Enclosure Project

The Contractor's attention is directed to the Special Provision 000-6233, "Important Notice to Contractors", and "Statement of Material and Other Charges" which will be included in all projects, beginning with the September 1991 letting. These establish the procedures whereby the Contractor will be permitted to obtain an exemption from sales tax on certain materials. See Comptroller's Rule 3.291 and Texas Tax Code, Chapter 151, as amended by House Bill Number 11, Acts 1991, 72<sup>nd</sup> Legislature, First Called Session. The Contractor will be required to separate the charges for materials from all other charges and will be furnished an Exemption Certificate for each contract by the Department. Also, the Contractor must issue resale certificates to suppliers. Sales tax permit applications and information regarding resale certificates may be obtained by calling the State Comptrollers' tollfree number 1-800-252-5555.

SPECIAL PROVISION

No. 000-6233

IMPORTANT INFORMATION TO CONTRACTORS

The Contractor's attention is directed to rule 3.291, paragraphs (a) (1), defining separated contracts, subsection (b) (3), discussing separated contracts, and subsection (c), discussing exempt contracts. Reference: Texas Tax Code, Chapter 151.

Contractors should note those organizations in subsection (c) that the rule shows as being exempt no longer qualify for the exemption. The rule states that contractors improving realty for organizations listed in Texas Tax Code 151.309 and 151.310 are exempt from tax. **THIS IS NO LONGER TRUE EFFECTIVE WITH CONTRACTS SIGNED ON OR AFTER AUGUST 15, 1991.**

Only those contracts with school districts and nonprofit hospitals qualify for the exemption discussed in subsection (c) of Rule 3.291.

The Comptroller is amending the rule to reflect this change.

If the low bidder elects to operate under separated contract as defined by Rule 3.291, by obtaining the necessary permits from the State Comptroller's office allowing the purchase of materials for incorporation in this project without having to pay the Limited Sales and Use Tax at the time of purchase, the low bidder shall identify separately from all other charges the total agreed contract price for materials incorporated into the project. This form shall be filled out by the low bidder in each of the two bound copies of the contract. Total materials shall only include materials physically incorporated into the realty.

If the Contractor operates under a "separated contract", the Department will furnish the Contractor with an exemption certificate for the applicable materials.

In order to comply with the requirements of Rule 3.291, as mentioned above, it will be necessary for the Contractor to obtain a sales tax permit.

It will also be necessary that the Contractor Issue resale certificates to his suppliers.

Sales tax application for a sales tax permit and information regarding resale certificates may be obtained by writing to:

Comptroller of Public Accounts  
Capital Station  
Austin, Texas 78774

The contractor may also receive information or request sales tax permit applications by calling the State Comptroller's tollfree number 1-800-252-5555.

Subcontractors are eligible for sales tax exemption if the subcontract is made in such manner that the charges for materials are separated from all other charges. The procedure described above will affect a satisfactory separation. When subcontractors are handled in this manner, the Contractor must issue a resale certificate to the manner, the Contractor must issue a resale to the subcontractor and the subcontractor, in turn, must issue a resale certificate to his supplier.

STATEMENT OF MATERIALS AND OTHER CHARGES

MATERIALS INCORPORATED INTO THE PROJECT: \$ \_\_\_\_\_

ALL OTHER CHARGES: \$ \_\_\_\_\_

\*TOTAL: \$ \_\_\_\_\_

\*This total must agree with the total figure shown in the Item and Quantity Sheets in the bound Contract.

For purposes of complying with the Texas Tax Code, the Contractor agrees that the charges for any material incorporated into the project in excess of the estimated quantity provided for herein will be no less than the invoice price for such material to the Contractor.

NOTE: ONLY THE COPY OF THIS FORM IN THE BOUND CONTRACTS IS TO BE FILLED OUT.

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**PROPOSAL AND AFFIDAVIT**

To: The City of Laredo, Texas  
Attn: Honorable Mayor Dr. Victor D. Trevino

From: \_\_\_\_\_  
Contractor

Address: \_\_\_\_\_  
\_\_\_\_\_

**PROJECT: South Laredo Wastewater Treatment Plant Blower Building Enclosure Project**

Pursuant to Notice to Bidders, the undersigned bidder hereby proposes to furnish the labor, materials, and equipment in accordance with the plans and specifications, General Conditions of the Agreement, special provisions of the Agreement, and Addenda, if any. The bidder binds himself upon acceptance of his proposal to execute a contract and bonds on the accompanying form for performing and completing the said work within the time stated as required by the detailed specifications at the following unit prices. The quantities shown below are based on the Engineer's estimate of quantities and it is agreed that the quantities may be increased or decreased, as may be considered necessary in the opinion of the City of Laredo, Texas, to complete the work fully as planned and contemplated, and that all quantities of work, either increased or decreased, are to be performed at the unit prices set forth below (except as provided in the General Conditions of the Agreement or the specifications, or the contract documents).

Acknowledgment of Addenda: (Please initial and date)

Addendum No. 1: \_\_\_\_\_

Addendum No. 2: \_\_\_\_\_

Addendum No. 3: \_\_\_\_\_

Addendum No. 4: \_\_\_\_\_

Addendum No. 5: \_\_\_\_\_

Acknowledgment of other documents: (Please initial and date):

Wage Determination: \_\_\_\_\_

Labor Provisions: \_\_\_\_\_

Affirmative Action Program: \_\_\_\_\_

NON-COLLUSION AFFIDAVIT

STATE OF TEXAS { }

COUNTY OF WEBB { }

\_\_\_\_\_
being first duly sworn, deposes and says

That he is \_\_\_\_\_
(a Partner or Officer of the firm of, etc.)

the party making the foregoing proposal or bid, that such proposal or bid is genuine and not collusive or sham; that said Bidder has not colluded, conspired, connived or agreed, directly or indirectly, with any Bidder or Person, to put in a sham bid or to refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference, with any person, to fix the bid price of affiant or of any other Bidder, or to fix any overhead, profit or cost element of said bid price, or of that of any other Bidder, or to secure any advantage against the City of Laredo or any person interested in the proposed Contract; and that all statements in said proposal or bid are true.

\_\_\_\_\_
Signature of
Bidder, if the Bidder is an individual Partner, if the Bidder is a Partnership Officer, if the Bidder is a corporation

Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_, 2024.

\_\_\_\_\_
Notary Public

My Commission expires
\_\_\_\_\_

**PROJECT: South Laredo Wastewater Treatment Plant Blower Building Enclosure Project**

**INFORMATION FROM BIDDERS**

The Bidder shall furnish the following and it Must be Completed and Submitted with the Bid Proposal. Failure to provide the information will cause the Bid to be non-responsive and may cause its rejection.

Statement of Qualifications: (Similar Municipal Water and/or Wastewater Projects completed within the last 7 years with a minimum construction cost of **\$500,000 by the Bidder**)

1. Name of Project: \_\_\_\_\_

Bidder's Project Manager: \_\_\_\_\_

Bidder's Project Superintendent: \_\_\_\_\_

Owner: \_\_\_\_\_

Value of Contract: \_\_\_\_\_

Date Completed: \_\_\_\_\_

Completed within the specified time: \_\_\_\_\_

If not, please explain why: \_\_\_\_\_

\_\_\_\_\_

Project Change Order Amounts: \$ \_\_\_\_\_

Owner Contact Person:

Owner Name: \_\_\_\_\_

Owner Address: \_\_\_\_\_

Owner Phone No.: \_\_\_\_\_

2. Name of Project: \_\_\_\_\_

Bidder's Project Manager: \_\_\_\_\_

Bidder's Project Superintendent: \_\_\_\_\_

Owner: \_\_\_\_\_

Value of Contract: \_\_\_\_\_

Date Completed: \_\_\_\_\_

Completed within the specified time: \_\_\_\_\_

If not, please explain why: \_\_\_\_\_  
\_\_\_\_\_

Project Change Order Amounts: \$ \_\_\_\_\_

Owner Contact Person:

Owner Name: \_\_\_\_\_

Owner Address: \_\_\_\_\_

Owner Phone No.: \_\_\_\_\_

3. Name of Project: \_\_\_\_\_

Bidder's Project Manager: \_\_\_\_\_

Bidder's Project Superintendent: \_\_\_\_\_

Owner: \_\_\_\_\_

Value of Contract: \_\_\_\_\_

Date Completed: \_\_\_\_\_

Completed within the specified time: \_\_\_\_\_

If not, please explain why: \_\_\_\_\_  
\_\_\_\_\_

Project Change Order Amounts: \$ \_\_\_\_\_

Owner Contact Person:

Owner Name: \_\_\_\_\_

Owner Address: \_\_\_\_\_

Owner Phone No.: \_\_\_\_\_

Experience Data: (Include name and attach experience record of the Proposed Project Superintendent and Proposed Project Manager for the South Laredo Wastewater Treatment Plant Blower Building Enclosure Project)

1. Name of Proposed Project Manager: \_\_\_\_\_
2. Name of Proposed Project Superintendent: \_\_\_\_\_

**Financial Status:** A confidential financial statement shall be submitted by the apparent successful low Bidder if the Owner deems it necessary.

**Subcontractors:** Submit with the Bid Proposal a list of proposed Subcontractors who will perform the following work as well as list the proposed subcontractors who will perform work having a value of more than five (5) percent of the total contract amount. The information provided will be used in the evaluation of the Bidder. At a minimum, the three (3) apparent low bidders shall provide the contact person address and phone number for the subcontractor listed and five (5) references as well as the subcontractor amount. The references shall be for similar size and type of project. The references shall include name of project, Owner contact information, Engineer contact information, and General Contractor contact information. The contact information shall include name, phone number, and address. The address and phone number and the references for the subcontractor shall be submitted to the Owner and Engineer within twenty – four (24) hours of the bid opening.

Subcontractor	Work to be Performed
	Electrical

CITY OF LAREDO  
UTILITIES DEPARTMENT

PROJECT: **South Laredo Wastewater Treatment Plant Blower Building Enclosure Project**

**BID SCHEDULE**

Item No.	Estimated Quantity	Unit	Name of Pay Item with Unit Bid Price Written in Words	Unit Bid (Figures)	Amount Bid (Figures)
<b>A. LUMP SUM BASE BID WORK</b>					
1	1	L.S.	Mobilization for contractor's forces and equipment necessary to perform the scope of work defined under the contract. Shall include costs for Contractor's insurances and bonds, construction/ building and stormwater permits and fees, job trailers and site administration expenses and utilities.	\$ _____	\$ _____
2	1	L.S.	Modifications to the South Laredo WWTP Blower Building to enclose the blower rooms, provide HVAC improvements, modify the blower process air intakes, cooling air intakes, and cabinet cooling exhaust, and other Work indicated in the Contract Documents.	\$ _____	\$ _____

**TOTAL – A. LUMP SUM BASE BID PRICE** \$ \_\_\_\_\_

**TOTAL – A. LUMP SUM BASE BID WRITTEN IN WORDS:** \_\_\_\_\_

\_\_\_\_\_ Dollars

and \_\_\_\_\_ Cents.

Item No.	Estimated Quantity	Unit	Name of Pay Item with Unit Bid Price Written in Words	Unit Bid (Figures)	Amount Bid (Figures)
<b>B. CASH ALLOANCES</b>					
3	1	L.S.	An allowance for miscellaneous additional related work including piping, equipment, structural, electrical, instrumentation and control, identified in written request to the Contractor during construction; complete in place and approved by the Owner.	\$ <u>50,000.00</u>	\$ <u>50,000.00</u>

**TOTAL – B. CASH ALLOWANCES** \$ \_\_\_\_\_

**TOTAL – B. CASH ALLOWANCES WRITTEN IN WORDS:** \_\_\_\_\_

\_\_\_\_\_ Dollars  
and \_\_\_\_\_ Cents.

**TOTAL BID PRICE (A+B)** \$ \_\_\_\_\_

**TOTAL BID PRICE (A+B) WRITTEN IN WORDS:** \_\_\_\_\_

\_\_\_\_\_ Dollars  
and \_\_\_\_\_ Cents.

**STATEMENT OF MATERIALS AND OTHER CHARGES**

**PROJECT: South Laredo Wastewater Treatment Plant Blower Building Enclosure Project**

MATERIALS INCORPORATED INTO THE PROJECT: \$ \_\_\_\_\_

ALL OTHER CHARGES: \$ \_\_\_\_\_

\*TOTAL: \$ \_\_\_\_\_

\*This total must agree with the total figure shown in the Item and Quantity Sheets in the bound contract.

For purposes of complying with the Texas Tax Code, the Contractor agrees that the charges for any material incorporated into the project in excess of the estimated quantity provided for herein will be no less than the invoice price for such material to the Contractor.

**NOTE: ONLY THE COPY OF THIS FORM IN THE BOUND CONTRACTS IS TO BE FILLED OUT**

The Bidder further agrees to pay, as Liquidated Damages, the amounts provided in Division B, Section 1 for failure to Substantially Complete and/or have Totally Complete and ready for Final Payment within the specified completion times.

BIDDER must answer the following questions (refer to INSTRUCTIONS FOR BIDDERS for definitions):

A. Is the bidder that is making and submitting this bid a "RESIDENT BIDDER" or a "NONRESIDENT BIDDER?"

Answer: \_\_\_\_\_

B. If the bidder is a "NONRESIDENT BIDDER", does the State in which the Nonresident Bidder's principal place of business is located have a law requiring a Nonresident Bidder of that State to bid a certain amount or percentage under the bid of a Resident Bidder of that State in order for the Nonresident Bidder of that State to be awarded a contract on his bid in such State?

Answer: \_\_\_\_\_

C. If the answer to Question B above is "yes", then what amount or percentage must a Texas Resident Bidder bid under the bid of a Resident Bidder of that State in order to be awarded a contract on such bid in said State?

Answer: \_\_\_\_\_

---

Contractor



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Signature \_\_\_\_\_ Title \_\_\_\_\_

---

Address \_\_\_\_\_ City/State \_\_\_\_\_ Zip Code \_\_\_\_\_

Telephone Number: \_\_\_\_\_

Fax Number: \_\_\_\_\_

Date: \_\_\_\_\_

NOTE: ALL BID ITEMS WILL BE PAID FOR WHEN COMPLETE IN PLACE, TESTED, AND ACCEPTED BY THE OWNER.

END OF SECTION

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BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned \_\_\_\_\_  
\_\_\_\_\_ as Principal and \_\_\_\_\_  
as Surety, are held and firmly bound unto the City of Laredo, Texas, hereinafter referred to as the  
Owner, in the penal sum of \_\_\_\_\_  
; for the payment of which, well and truly to be made, we hereby jointly and severally bid ourselves,  
our heirs, executors, administrator, successors and assigns.

Signed, this \_\_\_\_\_ day of \_\_\_\_\_, 2024.

The condition of the above obligation is such that whereas the Principal has submitted to the  
City of Laredo, Texas a certain Bid, attached hereto and hereby made a part hereof to enter into a  
Contract in writing for the South Laredo Wastewater Treatment Plant Blower Building Enclosure  
Project.

NOW THEREFORE,

- (a) If said Bid shall be rejected, or in the alternate,
- (b) If said Bid shall be accepted and the Principal shall execute and deliver a Contract in  
the Form of Contract attaches hereto (properly completed in accordance with said Bid)  
and shall furnish a bond for his faithful performance of said Contract, and for the  
payment of all persons performing labor or furnishing materials in connection  
therewith, and shall in all other respects perform the Agreement created by the  
acceptance of said Bid,

Then this obligation shall void, otherwise the same shall remain in force and effect; it being  
expressly understood and agreed that the liability of the Surety for any and all claims hereunder  
shall, in no event, exceed the penal amount of this obligation as herein stated.

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

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

\_\_\_\_\_  
Principal

\_\_\_\_\_  
Surety

By: \_\_\_\_\_  
(Seal)

By: \_\_\_\_\_  
(Seal)

## CHECKLIST FOR BIDDERS

Project: South Laredo Wastewater Treatment Plant Blower Building Enclosure Project

All information required by the terms of the Bid Documents must be furnished. **MISTAKES OR OMISSIONS CAN BE COSTLY AND CAN RESULT IN THE REJECTION OF YOUR BID.** Important items for you to check are included in but not limited to, those listed below. This checklist is furnished only to assist you in submitting a proper bid. Check as you read. **DO NOT INCLUDE THIS CHECKLIST WITH YOUR BID.**

- Have you acknowledged receipt of all addenda to the plans and specifications?
- Is your bid properly signed? (Refer to Bid Documents)
- If a bid guarantee is required, is it included in your bid? (A late bid guarantee is treated the same as a late bid)
- Is your bid guarantee in the proper amount? (Usually 10% of total bid price)
- Your bid guarantee must be in the form of a Bidder's Bond, a Certified Check or Cashier's Check.
- If your bid guarantee is in the form of a Bidder's Bond, is the bond properly signed by both the bidder and surety and are all required seals affixed?
- Is the surety company qualified and licensed by the State of Texas as required by the provisions of the bid documents?
- Is the name in which you submitted the bid the same on your bid proposal as on the Bidder's Bond?
- If required have you entered a unit price for each bid item?
- If required have you entered the unit price or lump sum price in both words and figures? (Unit Price or Lump Sum price in words govern)
- Are decimals in unit prices in the proper places? Are your figures legible?
- Are the extensions of your unit prices, and your total bid price correct?
- Proposals are required to be submitted in duplicate. Are they identical? The duplicate proposal may be a reproduced copy.
- Are all erasures or corrections initialized by the person signing the bid or by an authorized representative of the person signing the bid.
- Do not restrict your bid by altering any provisions of the Bid Document or by attaching any documents to the Proposal that takes exception to the Bid Documents.

- [ ] Have you included all pages of the Proposal with your bid? Are all blanks in the Proposal properly completed (equipment brands, alternate materials, etc.)?
- [ ] Is the envelope containing your bid properly identified that it is a sealed bid and does it contain the correct project name and bid opening date?
- [ ] Will your bid arrive on time? Late bids will not be considered. Generally, bids must be received by the City Secretary, City Hall on the date and time specified in the Notice to Bidders. (Other times or dates will be clearly specified in the Notice).

CONSTRUCTION CONTRACT

**Agenda Item:** \_\_\_\_\_

STATE OF TEXAS  
COUNTY OF WEBB

THIS AGREEMENT, made this \_\_\_\_\_ day of \_\_\_\_\_ by and between the City of Laredo, Texas, acting by and through its duly authorized City Manager hereinafter termed the Owner, and \_\_\_\_\_ of the City of \_\_\_\_\_, County of \_\_\_\_\_, State of \_\_\_\_\_, his/their executors, administrators, heirs, successors, or assigns, hereinafter termed the Contractor.

WHEREAS, the Owner desired to enter into Contract for the South Laredo Wastewater Treatment Plant Blower Building Enclosure Project in accordance with the provisions of the Invitation for Bids, the Specifications and Plans titled as above, and published by City of Laredo, Texas, 1110 Houston Street, (mailing address: P.O. Box 579), Laredo, Texas 78040 all of which are a part thereof; and,

WHEREAS, the Contractor has been engaged in and now does such work and represents that he is fully equipped, competent and capable to perform the above desired and outlined work, and is ready and willing to perform the work in accordance with the provisions of the Invitation for Bids, the Specifications and Plans, titled, "**South Laredo Wastewater Treatment Blower Building Enclosure Project.**"

WITNESS:

THAT for and in consideration of the payments and agreements hereinafter mentioned to be made and performed by the Owner, the Contractor hereby agrees at the unit price set forth in his Bid, made a part thereof totaling the sum of \_\_\_\_\_ (\$\_\_\_\_\_ ) based on the Engineer's estimate of quantities, payable in the manner set out in Division C, Section 9, General Provisions of the contractual Documents to commence and complete the **South Laredo Wastewater Treatment Blower Building Enclosure Project** the City of Laredo, TX, in accordance with Instructions to Bidders, Special Provisions, General Provisions, Technical Provisions, and all other requirements of the contractual Documents, and in accordance with the Specifications and Plans (including all maps, plats, blueprints, and other drawings and printed or written explanatory matter thereof) prepared by the Owner's Engineer, a part thereof and collectively, together with this Agreement constitute the entire Contract; and the Contractor agrees to furnish all the materials, supplies, machinery, equipment, tools, superintendence, labor, insurance, and other insurance and other accessories and services, and whatever else may be necessary to complete the said construction in accordance with said specifications, plans, and other contractual documents including such proposal.

Said Contractor further agrees to begin the work on or before the tenth day following the date set by the Owner in the written notice to proceed and to complete the work within **300 calendar days.**

The Contractor further agrees to pay, as liquidated damages, the sum of **\$ 250.00** for each calendar day that the work is not Substantially Completed within the time specified, and the sum of **\$ 250** for each calendar day that the work is not totally complete and ready for Final Payment as herein provided in Division B.

And the Owner in consideration of the full and true performance of the said work by said Contractor hereby agrees to and binds itself to pay the said Contractor the unit price set forth in the attached Bid, and in the manner provided in the Specifications.

IN WITNESS WHEREOF, the OWNER AND THE CONTRACTOR have hereunto set their hand this \_\_\_ day of \_\_\_\_\_.

WITNESS:

Contractor/Firm (Typed)

\_\_\_\_\_  
Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Address

\_\_\_\_\_  
Signature (Typed)

Title: \_\_\_\_\_

\_\_\_\_\_  
Address

\_\_\_\_\_  
City/State/Zip Code

\_\_\_\_\_  
Telephone Number

\_\_\_\_\_  
Fax Number

ATTEST:

CITY OF LAREDO, TEXAS

\_\_\_\_\_  
Jose A. Valdez, Jr., City Secretary

\_\_\_\_\_  
Joseph Neeb, City Manager

APPROVED AS TO FORM:

\_\_\_\_\_  
Doanh T. Nguyen, Acting City Attorney

PERFORMANCE BOND

(To be Used in Texas under V.A.T.S. 5160)

THE STATE OF \_\_\_\_\_ {}

COUNTY OF \_\_\_\_\_ {}

KNOW ALL MEN BY THESE PRESENTS: That we (1)

\_\_\_\_\_ a

(2) \_\_\_\_\_ of \_\_\_\_\_,

hereafter called Principal and (3) \_\_\_\_\_

of \_\_\_\_\_, State of \_\_\_\_\_, hereinafter called the Surety, are held and firmly

bound unto (4) the City of Laredo, Texas hereinafter called Owner, in the penal sum of

\_\_\_\_\_ Dollars

(\$ \_\_\_\_\_ ) in lawful money of the United States, to be paid in (5) **WEBB COUNTY,**

**TEXAS,** 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 CONDITIONS OF THIS OBLIGATION are such that Whereas, the Principal entered into a certain Contract with (6) **the City of Laredo, Texas,** the Owner, dated the \_\_\_\_ day of \_\_, 2024 a copy of which is hereto attached and made a part hereof for the construction of:

**South Laredo Wastewater Treatment Plant Blower Building Enclosure Project.**

(hereinafter called the "Work")

Date of Bond must not be prior to Date of Contract.

These notes refer to the numbers in body of Contract above:

- (1) Correct name of Contractor.
- (2) A Corporation, or Partnership or an Individual, as case may be
- (3) Correct name of Surety.
- (4) Correct name of Owner.
- (5) County and State.
- (6) Owner

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform the work in accordance with the Plans, Specifications and Contract Documents during the original term thereof, and any extensions thereof which may be granted by the Owner with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such Contract, and shall fully indemnify and save harmless the Owner



from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED FURTHER, that if any legal action be filed upon this Bond, venue shall lie in WEBB County, State of Texas, and that 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 or the Specifications accompanying the same shall in any way affect its obligation 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.

IN WITNESS WHEREOF, this Instrument is executed in six counterparts, each one of which shall be deemed an original, this the \_\_\_\_ day of \_\_\_\_\_, 2024.

ATTEST:

\_\_\_\_\_  
(Principal) Secretary

\_\_\_\_\_  
PRINCIPAL

(SEAL)

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

\_\_\_\_\_  
Address (State & Zip Code)

\_\_\_\_\_  
Witness as to Principal

\_\_\_\_\_  
Telephone No. (Area Code)

\_\_\_\_\_  
Address (State & Zip Code)

ATTEST:

\_\_\_\_\_  
Secretary

\_\_\_\_\_  
SURETY: (Surety)

SEAL

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

Attorney-in-Fact

\_\_\_\_\_  
(Surety) Secretary

\_\_\_\_\_  
Address (State & Zip Code)

SEAL

\_\_\_\_\_  
Telephone No. (Area Code)

\_\_\_\_\_  
Witness as to Surety

\_\_\_\_\_  
Address (State & Zip Code)

PAYMENT BOND

(To be Used in Texas under V.A.T.S. 5160)

THE STATE OF \_\_\_\_\_ {}

COUNTY OF \_\_\_\_\_ {}

KNOW ALL MEN BY THESE PRESENTS: That we (1)

\_\_\_\_\_ a

(2) \_\_\_\_\_ of \_\_\_\_\_,

hereafter called Principal and (3) \_\_\_\_\_

of \_\_\_\_\_, State of \_\_\_\_\_, hereinafter called the Surety, are held and firmly

bound unto (4) the City of Laredo, Texas hereinafter called Owner, and unto all Persons, Firms, and

Corporations who may furnish materials for, or perform labor upon the building or improvements

hereinafter referred to in the penal sum of \_\_\_\_\_ Dollars

(\$ \_\_\_\_\_) in lawful money of the United States, to be paid in (5) **WEBB COUNTY,**

**TEXAS** 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 CONDITIONS OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain Contract with (6) **City of Laredo, Texas**, the Owner, dated the \_\_\_\_\_ day of \_\_\_\_\_, 2024, a copy of which is hereto attached and made a part hereof for the construction of:

**South Laredo Wastewater Treatment Plant Blower Building Enclosure Project.** (hereinafter called the "Work")

Date of Bond must not be prior to Date of Contract.

These footnotes refer to the numbers in body of contract above:

- (1) Correct name of Contractor.
- (2) A Corporation, or Partnership or an Individual, as case may be
- (3) Correct name of Surety.
- (4) Correct name of Owner.
- (5) County and State.
- (6) Owner

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform the work in accordance with the Plans, Specifications and Contract Documents during the original term thereof, and any extensions thereof which may be granted by the Owner with or without notice to the Surety, and if he shall satisfy all

claims and demands incurred under such Contract, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

This Bond is made and entered into solely for the prosecution of all claimants supplying labor and material in the prosecution of the work provided for in said Contract, and all such claimants shall have a direct right of action under the Bond as provided in Article 5160, Revised Civil Statutes 1925, as amended by House Bill 344, Acts 46 Legislature, Regular Session, 1959.

PROVIDED FURTHER, that if any legal action be filed upon this Bond, venue shall lie **WEBB** County, State of Texas, and that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any way affect its obligation 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.

PROVIDED FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in six counterparts, each one of which shall be deemed an original, this the \_\_\_\_ **day of** \_\_\_\_\_, **2024**.

ATTEST:

\_\_\_\_\_  
(Principal) Secretary

\_\_\_\_\_  
PRINCIPAL

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

(SEAL)

\_\_\_\_\_  
Address (State & Zip Code)

\_\_\_\_\_  
Witness as to Principal

\_\_\_\_\_  
Telephone No. (Area Code)

\_\_\_\_\_  
Address (State & Zip Code)

ATTEST:

\_\_\_\_\_  
(Surety) Secretary

\_\_\_\_\_  
SURETY: (Surety)

By: \_\_\_\_\_  
Attorney-in-Fact

SEAL

\_\_\_\_\_  
Witness as to Surety

\_\_\_\_\_  
Address (State & Zip Code)

\_\_\_\_\_  
Address (State & Zip Code)

\_\_\_\_\_  
Telephone No. (Area Code)

NOTE: If Contractor is Partnership, all Partners should execute Bond.

PERFORMANCE - PAYMENT BOND FORM

\_\_\_\_\_

\_\_\_\_\_  
Individual Principal (SEAL)

\_\_\_\_\_  
Address (State & Zip Code)

\_\_\_\_\_  
Business-Address

\_\_\_\_\_  
Telephone Number (Area Code)

\_\_\_\_\_  
Telephone Number (Area Code)

ATTEST:

\_\_\_\_\_  
Corporate Principal

\_\_\_\_\_  
(State & Zip Code)

\_\_\_\_\_  
Business Address Name

\_\_\_\_\_  
Telephone Number (Area Code)

\_\_\_\_\_  
Address (State & Zip Code)

\_\_\_\_\_  
Affix Corporate Seal

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

\_\_\_\_\_  
Address (State & Zip Code)

\_\_\_\_\_  
Corporate Surety

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
(Affix Corporate Seal)

\_\_\_\_\_  
Telephone Number (Area Code)

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, \_\_\_\_\_, certify that I am the Secretary of the Corporation named as Principal in the within Bond; that \_\_\_\_\_, who signed the said Bond on behalf of the Principal was then \_\_\_\_\_, of said Corporation; that I know his signature thereof is genuine; and that said Bond was duly signed, sealed, and attested for and in behalf of said Corporation by authority of its governing body.

\_\_\_\_\_  
Title

\_\_\_\_\_

Date: \_\_\_\_\_

(Affix Corporate Seal)

\_\_\_\_\_  
Telephone No.

The rate of premium on this Bond is \_\_\_\_\_ per thousand.

Total of premium charge \$ \_\_\_\_\_

NOTE: The above must be filled in by Corporate Surety.  
Power-of-Attorney of person signing for Surety company must be attached.

CERTIFICATE OF OWNER'S ATTORNEY

Project: South Laredo Wastewater Treatment Plant Blower Building Enclosure Project

Awarded by the City Council: \_\_\_\_\_

I, the undersigned, Doanh T. Nguyen, Acting City Attorney, the duly authorized and acting legal representative of the CITY OF LAREDO, do hereby certify as follows:

I have examined the attached Contract(s) and Surety bonds and the manner of execution thereof, and I am of the opinion that each of the aforesaid Agreements has been duly executed by the proper parties thereto acting through their purported duly authorized representatives; that said representatives purport to have full power and the authority to execute said Agreements on behalf of the respective parties named thereon; and that the foregoing Agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions, and provisions thereof.

\_\_\_\_\_  
Doanh T. Nguyen,  
Acting City Attorney

Date: \_\_\_\_\_

2517-247787

City of Laredo - South Laredo Wastewater Treatment Plant  
Blower Building Enclosure Project

Division A

**CERTIFICATE OF OWNER'S ATTORNEY**

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### CONTRACTOR'S AND SUBCONTRACTOR'S INSURANCE

The Contractor shall not commence work under this Contract until he/she has obtained all the insurance required under this paragraph and such insurance has been approved by the Owner, nor shall the Contractor allow any subcontractor to commence work on his/her Sub-Contract until the insurance required of the Subcontractor has been so obtained and approved.

- a. **Compensation Insurance:** The Contractor shall procure and shall maintain during the life of this Contract Workmen's Compensation Insurance as required by applicable State or Territorial law for all of his/her employees to be engaged in work at the site of the project under this Contract and, in case of any such work sublet, the Contractor shall require the Subcontractor similarly to provide Workmen's Compensation Insurance for all of the latter's employees to be engaged in such work unless such employees are covered by the protection afforded by the Contractor's Workmen's Compensation Insurance. In the case where any class of employees engaged in hazardous work on the project under this Contract is not protected under the Workmen's Compensation Statute, the Contractor shall provide and shall cause each Subcontractor to provide adequate employee's liability insurance for the protection of such of his/her employee as are not otherwise protected.
- b. **Contractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance:** The Contractor shall procure and maintain during the life of his Contract: Contractor's Public Liability Insurance, Contractor's Property Damage Insurance and Vehicle Liability Insurance in the amount of not less than \$200,000 for bodily injury, including accidental death, to any one person and an amount not less than \$300,000 on account of any one occurrence: Property Damage in the amount not less than \$100,000 per occurrence and \$200,000 aggregate; and Vehicle Liability of \$100,000 for any one person or \$200,000 for each occurrence.
- c. **Subcontractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance:** The Contractor shall either (1) require each of his/her Subcontractor to procure and maintain during the life of his /her Subcontract, Subcontractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance of the type and in the amount specified in Subparagraph b. above, or (2) insure the activities of his/her Subcontractors in his/her policy specified in Subparagraph b. above.
- d. **Scope of Insurance and Special Hazards:** The insurance required under Subparagraph b. and c. above shall provide adequate protection for the Contractor and his/her Subcontractors, respectively, against damage claims which may arise from operations under this Contract, whether such operations be by the insured or by any one directly or indirectly employed by him/her and also against any of the special hazards which may be encountered in the performance of this Contract.
- e. **Builder's Risk Insurance (Fire and Extended Coverage):** Unless otherwise provided by the Owner, the Contractor shall procure and maintain during the life of this Contract Builder's Risk Insurance (Fire and Extended Coverage) on a 100 percent (100%) completed value basis on the insurable portion of the project. The Owner, the Contractor, and Subcontractor (as their interests may appear), shall be named as the Insured.
- f. **Proof of Carriage of Insurance:** The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates and dates of expiration of policies. Such certificates shall also contain substantially the following statement: "The Insurance covered by this certificate will not be cancelled or materially altered, except after ten (10) days written notice has been received by the Owner".



CERTIFICATE OF INSURANCE

To: **CITY OF LAREDO** Date:       /      / 2024

Address: City Secretary  
1110 Houston Street. 3<sup>rd</sup> Floor  
Laredo, Texas 78044

Project: South Laredo Wastewater Treatment Plant Blower Building Enclosure Project

This is to certify that \_\_\_\_\_  
Name, Address and Telephone Number of Insured

is, at the date of this certificate, insured by this Company with respect to the business operations hereinafter described for the types of insurance and in accordance with the provisions of the standard policies used by this company, and further, hereinafter described. Exceptions to standard policy noted on reverse side hereof.

Type of Insurance: \_\_\_\_\_

Policy No. \_\_\_\_\_

Effective Date: \_\_\_\_\_ Expires: \_\_\_\_\_

Limits of availability: \_\_\_\_\_

Worker's Compensation: \_\_\_\_\_

Public Liability: \_\_\_\_\_ 1 Person: \$ \_\_\_\_\_  
1 Accident: \$ \_\_\_\_\_

Contingent Liability: \_\_\_\_\_

Property Damage: \_\_\_\_\_

Builder's Risk: \_\_\_\_\_

Automobile: \_\_\_\_\_

Other: \_\_\_\_\_

The foregoing policies (do) (do not) cover all subcontractors

Locations covered: \_\_\_\_\_

Description of Operations covered: \_\_\_\_\_

\_\_\_\_\_

The above policies either in the body thereof or by appropriate endorsement, provide that they may not be changed or cancelled by the insurer in less than five days after the insured has received written notice of such change or cancellation.

WITNESS:

Contractor/Firm (Typed)

\_\_\_\_\_  
Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Address

\_\_\_\_\_  
Signature (Typed)

\_\_\_\_\_  
Title

\_\_\_\_\_  
Address

\_\_\_\_\_  
City/State/Zip Code

\_\_\_\_\_  
Telephone Number

\_\_\_\_\_  
Fax Number

NOTICE:

All persons providing services on this construction project shall abide by TAC, Title 28, §110.110, Reporting Requirements for Building or Construction Projects for Governmental Entities.

This rule is applicable for building or construction contracts advertised for bid by a governmental entity on or after September 1, 1994.

(see copy of §110.110 attached)

Rule §110.110 Reporting Requirements for Building or Construction Projects for Governmental Entities

- (a) The following words and terms, when used in this rule, shall have the following meanings, unless the context clearly indicates otherwise. Terms not defined in this rule shall have the meaning defined in the Texas Labor Code, if so defined.
- (1) Certificate of Coverage (“certificate”) - A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or coverage agreement (DWC-81, DWC-82, DWC-83, DWC-84), showing statutory workers’ compensation insurance coverage for the person’s or entity’s employees (including those subject to a coverage agreement) providing services on a project, for the duration of the project.
  - (2) Building or construction - Has the meaning defined in the Texas Labor Code, §406.096(e)(1).
  - (3) Contractor - A person bidding for or awarded a building or construction project by governmental entity.
  - (4) Coverage - Workers’ compensation insurance meeting the statutory requirements of the Texas Labor Code, §401.011(44).
  - (5) Coverage agreement - A written agreement on form TWCC-81, form TWCC-82, form TWCC-83, or form TWCC-84, filed with the Texas Workers’ Compensation Commission which establishes a relationship between the parties for purposes of the Workers’ Compensation Act, pursuant to the Texas Labor Code, Chapter 406, Subchapters F and G as one of the employer/employee and establishes who will be responsible for providing workers’ compensation coverage for persons providing services on the project.
  - (6) Duration of the project - Includes the time from the beginning of the work on the project until the work on the project has been completed and accepted by the governmental entity.
  - (7) Person providing services on this project (“subcontractor” in §406.096 of the Act) - Includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person has employees. This includes but is not limited to independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity furnishing persons to perform services on the project. “Services” includes but is not limited to providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. “Service” does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

- (8) Project - Includes the provision of all services related to a building or construction contract for a governmental entity.
- (b) Providing or causing to be provided a certificate of coverage pursuant to this rule is a representation by the insured that all employees of the insured who are providing services on the project are covered by workers' compensation coverage, that the coverage is based on proper reporting of classification codes and payroll amounts, and that all coverage agreements have been filed with the appropriate insurance carrier or, in the case of self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading certificates of coverage, or failing to provide or maintain required coverage, or failing to report any change that materially affects the provision of coverage may subject the contractor or other person providing services on the project to administrative penalties, criminal penalties, civil penalties, or other civil actions.
- (c) A governmental entity that enters into a building or construction contract on a project shall:
- (1) Include in the bid specifications, all the provisions of subsections (d) of this rule, using the language required by paragraph (7) of this subsection;
  - (2) as part of the contract, using the language required by paragraph (7) of this subsection, require the contractor to perform as required in subsection (d) of this rule;
  - (3) obtain from the contractor a certificate of coverage for each person providing services of the project, prior to that person beginning work on the project;
  - (4) obtain from the contractor a new certificate of coverage showing extension of coverage:
    - (A) before the end of the current coverage period, if the contractor's current certificate of coverage shows that the coverage period ends during the duration of the project; and
    - (B) no later than seven days after the expiration of the coverage for each other person providing services on the project whose current certificate shows that the coverage period ends during the duration of the project;
  - (5) retain certificates of coverage on file for the duration of the project and for three years thereafter;
  - (6) provide a copy of the certificate of coverage to the commission upon request and to any person entitled to them by law; and
  - (7) use the following language for bid specifications and contracts, without any additional words or changes, except those required to accommodate the specific document in which that are contained or to impose stricter standards of documentation:

Article     . *Workers' Compensation Insurance Coverage.*

A. *Definitions:*

*Certificate of Coverage ("certificate") - A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or coverage agreement (TWCC-81, TWCC-82, TWCC-83, TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project, for the duration of the project.*

*Duration of the project - Includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the governmental entity.*

*Person providing services on this project ("subcontractor" in §406.096) - Includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person contracted directly with contractor and regardless of whether that person has employees. This includes but is not limited to independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity furnishing persons to perform services on the project. "Services" includes but is not limited to providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Service" does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.*

- B. *The contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets that statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the contractor providing services on the project, for the duration of the project.*
- C. *The contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.*
- D. *If the coverage period shown on the contractor's current certificate of coverage ends during the duration of the project, the contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.*

- E. The contractor shall obtain from each person beginning work on the project, and provide to the governmental entity:*
- (1) a certificate of coverage, prior to that person beginning work on the project, so the governmental entity will have on file certificates of coverage for all persons providing services on the project; and*
  - (2) no later than seven days after the receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period ends during the duration of the project;*
- F. The contractor shall retain all required certificates of coverage for the duration of the project and for one year thereafter.*
- G. The contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.*
- H. The contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.*
- I. The contractor shall contractually require each person with whom it contracts to provide services on a project, to:*
- (1) provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project;*
  - (2) provide to the contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project;*
  - (3) provide the contractor, prior to the end of the coverage, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;*

- (4) *obtain from each other person with whom it contracts, and provide to the contractor:*
    - (a) *a certificate of coverage, prior to the other person beginning work on the project; and*
    - (b) *a new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate ends during the duration of the project;*
  - (5) *retain all required certificates of coverage on file for the duration of the project and for one year thereafter;*
  - (6) *notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and*
  - (7) *contractually require each person with whom it contracts, to perform as required by paragraphs (1) – (7), with the certificates of coverage to be provided to the person for whom they are providing services.*
- J. *By signing this contract or providing or causing to be provided a certificate of coverage, the contractor is representing to the governmental entity that all employees of the contractor who will provide services on the project will be covered by the workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.*
- K. *The contractor's failure to comply with any of these provisions is a breach of contract by the contractor which entitles the governmental entity to declare the contract void if the contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.*
- (d) A contractor shall:
- (1) provide coverage for its employees providing services on a project, for the duration of the project based on proper reporting of classification codes and payroll amounts and filing for any coverage agreements;



- (2) provide a certificate of coverage showing workers' compensation coverage to the governmental entity prior to beginning work on the project;
- (3) provide the governmental entity, prior to the end of the coverage period, a new certificate of coverage showing extensions of coverage, if the coverage period shown on the contractor's current certificate of coverage ends during the duration of the project;
- (4) obtain from each person providing services on a project, and provide to the governmental entity:
  - (A) a certificate of coverage, prior to the other person beginning work on the project, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project; and
  - (B) no later than seven days after receipt by the contractor, a new certificate of coverage showing extension of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
- (5) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;
- (6) notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project;
- (7) post a notice on each project site informing all persons providing services on the project that they are required to be covered, and stating how a person may verify current coverage and report failure to provide coverage. This notice does not satisfy other posting requirements imposed by the Act or other commission rules. This notice must be printed with a title in at least 30 point bold type and text at least 19 point normal type, and shall be in both English and Spanish and any other language common to the worker population. The text for the notices shall be the following text provided by the commission on the sample notice, without any additional words or changes:

*REQUIRED WORKERS' COMPENSATION COVERAGE*

*"The law requires that each person working on this site or providing services related to this construction project must be covered by this workers' compensation insurance. This includes persons providing, hauling, or delivering equipment or materials, or providing labor or transportation or other services related to the project, regardless of the identity of their employer or status as an employee."*

*"Call the Texas Workers' Compensation Commission at 512-440-3789 to receive information on the legal requirement for coverage, to verify whether your employer had*

*provided the required coverage, or to report an employer's failure to provide coverage."*

and

- (8) contractually require each person with whom it contracts to provide services on a project, to:
- (A) provide coverage based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements for all of its employees providing services on the project, for the duration of the project;
  - (B) provide a certificate of coverage to the contractor prior to that person beginning work on the project;
  - (C) include in all contracts to provide services on the project the language in subsection (e)(3) of this rule;
  - (D) provide the contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of the coverage, if the coverage period shown on the certificate of coverage ends during the duration of the project;
  - (E) obtain from each other person with whom it contracts, and provide to the contractor:
    - (i) a certificate of coverage, prior to the other person beginning the work on the project; and
    - (ii) prior to the end of the coverage period, a new certificate of coverage showing extension of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
  - (F) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;
  - (G) notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and
  - (H) contractually require each other person with whom it contracts, to perform as required by paragraphs (A) – (H), with the certificate of coverage to be provided to the person for whom they are providing services.

- (e) A person providing services on a project, other than the contractor, shall:
- (1) provide coverage for its employees providing services on a project, for the duration of the project based on proper reporting of classification codes and payroll amounts and filing for any coverage agreements;
  - (2) provide a certificate of coverage as required by its contract to provide services on the project, prior to beginning work on the project;
  - (3) have the following language in its contract to provide services on the project:

“By signing this contract or providing or causing to be provided a certificate of coverage, the person signing this contract is representing to the governmental entity that all employees of the person signing this contract who will provide services on the project will be covered by workers’ compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured carrier, with the commission’s Division of Self-Insurance Regulation. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.”
  - (4) provide the person for whom it is providing services on the project, prior to the end of the coverage period shown on its current certificate of coverage, a new certificate showing extension of coverage, if the coverage period shown on the certificate of coverage ends during the duration of the project;
  - (5) obtain from each person providing services on a project under contract to it, and provide as required by its contract:
    - (A) a certificate of coverage, prior to the other person beginning work on the project; and
    - (B) prior to the end of the coverage period, a new certificate of coverage showing extension of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
  - (6) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;
  - (7) notify the governmental entity in writing by certified mail or personal delivery, of any changes that materially affects the provision of coverage of any person providing

services on the project and send the notices within 10 days after the person knew or should have known of the change; and

- (8) contractually require each other person with whom it contracts to:
- (A) provide coverage based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements for all of its employees providing services on the project, for the duration of the project;
  - (B) provide a certificate of coverage to it prior to that other person beginning work on the project;
  - (C) include in all contracts to provide services on the project the language in subsection (e)(3) of this rule;
  - (D) provide, prior to the end of the coverage period, a new certificate of coverage showing extension of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
  - (E) obtain from each other person under contract to it to provide services on the project, and provide as required by contract:
    - (i) a certificate of coverage, prior to the other person beginning the work on the project; and
    - (ii) prior to the end of the coverage period, a new certificate of coverage showing extension of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
  - (F) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;
  - (G) notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and
  - (H) contractually require each person with whom it contracts, to perform as required by paragraphs (A) – (G), with the certificate of coverage to be provided to the person for whom they are providing services.
- (f) If any provision of this rule or its application to any person or circumstance is held invalid, the invalidity does not affect other provisions or applications of this rule that can be given effect

without the invalid provision or application, and to this end the provisions of this rule are declared to be severable.

- (g) This rule is applicable for building or construction contracts advertised for bid by a governmental entity on or after September 1, 1994. This rule is also applicable for those building or construction contracts entered into on or after September 1, 1994, which are not required by law to be advertised for bid.
- (h) The coverage requirement in this rule does not apply to motor carriers who are required pursuant to Texas Civil Statutes, Article 6675c, to register with the Texas Department of Transportation and who provide accidental insurance coverage pursuant to Texas Civil Statutes, Article 6675c, §4(j).
- (i) The coverage requirement in this rule does not apply to sole proprietors, partners, and corporate officers who meet the requirements of the Act, §406.097(c), and who are explicitly excluded from coverage in accordance with the Act, §406.097(a) (as added by House Bill 1089, 74th Legislature, 1995, §1.20). This subsection applies only to sole proprietors, partners, and corporate executive officers who are excluded from coverage in an insurance policy or certificate of authority to self-insure that is delivered, issued for delivery, or renewed on or after January 1, 1996.

Effective Date: September 1, 1994  
Amended: November 6, 1995

SECTION 1

CONTRACT TIME AND LIQUIDATED DAMAGES

Project: South Laredo Wastewater Treatment Plant Blower Building Expansion Project

A. Completion Time

The Contract Time for substantial completion for this project including all the work specified herein and shown on the Drawings shall be **270** Calendar Days from the Notice to Proceed. The Contract Time for Total Completion and ready for Final Payment for all work shall be **300** Calendar Days from the Notice to Proceed.

B. Liquidated Damages

Owner and Contractor recognize that time is of the essence for this Contract and that the Owner will suffer financial loss if the Work is not completed within the times specified above and in the Construction Contract, plus any extensions thereof allowed in accordance with the Contract Documents. They also recognize the delays, expense and difficulties involved in proving in a legal proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as Liquidated Damages for delay (but not as a penalty) Contractor shall pay Owner Liquidated Damages as defined below:

If Contractor should neglect, fail, or refuse to Substantially Complete the Demolition and Replacement of two Belt Filter Presses within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree as part of the consideration for awarding of this contract, that the Owner may withhold permanently from the Contractor's total compensation the sum of Two Hundred and Fifty Dollars (\$250.00 ) for each and every Calendar Day that the Contractor shall be in default after the time stipulated for Substantially Completing the work, not as a penalty, but as Liquidated Damages for the breach in contract.

If Contractor should neglect, fail, or refuse to complete the work within the time herein specified for having the work Totally Complete and ready for Final Payment, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree as part of the consideration for awarding this contract, that the Owner may withhold permanently from the Contractor's total compensation the sum of Two Hundred and Fifty Dollars \$250.00 for each any every Calendar Day that the Contractor shall be in default after the time stipulated for the work to be Totally Complete and ready for Final Payment, not as a penalty, but as Liquidated Damages for the breach in contract.

## SECTION 2

## EQUAL OPPORTUNITY CLAUSE

PROJECT: South Laredo Wastewater Treatment Plant Blower Building Enclosure Project

1. The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex or natural 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, creed, color or national origin. Such action shall include, but not 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 of training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of the non-discrimination 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 consideration for employment without regard to race, religion, color, sex or natural origin.
3. The Contractor will 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 by the agency contracting officer, advising the labor union or worker's representative of the Contractor's commitments under Section 202 of Executive Order No. 11246, as amended (3CFR 169 (1974) 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 No. 11246, as amended, 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 No. 11246, as amended, and by the rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records and accounts by the contracting 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 such 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 in accordance with procedures authorized in Executive Order No. 11246, as amended, and such other sanctions may be imposed and remedies invoke as provided in Executive Order No. 11246, as amended or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

7. The Contractor will include the Provisions of Paragraph 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 No. 11246, as amended, 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 contracting 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 contracting agency, the Contractor may request the United States to enter into such litigation to protect the interest of the United States.



PREVAILING WAGES

Project: South Laredo Wastewater Treatment Plant Blower Building Enclosure Project

Contractor shall be in compliance with all applicable requirements issued by the U.S. Department of Labor. The Wage and Hour Division of the U.S. Department of Labor determines prevailing wage rates to be paid on federally funded or assisted construction projects. Refer to prevailing wages for Webb County on following pages.

"General Decision Number: TX20240273 01/05/2024

Superseded General Decision Number: TX20230273

State: Texas

Construction Type: Building

County: Webb County in Texas.

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

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$17.20 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 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

BOIL0074-003 07/01/2023

	Rates	Fringes
BOILERMAKER.....	\$ 37.00	24.64

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ENGI0178-005 06/01/2020

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
(1) Tower Crane.....	\$ 32.85	13.10
(2) Cranes with Pile Driving or Caisson Attachment and Hydraulic Crane 60 tons and above.....	\$ 28.75	10.60
(3) Hydraulic cranes 59 Tons and under.....	\$ 32.35	13.10

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IRON0084-011 06/01/2023

	Rates	Fringes
IRONWORKER, ORNAMENTAL.....	\$ 27.51	8.13

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PLUM0412-004 04/01/2013

	Rates	Fringes
PLUMBER.....	\$ 31.14	12.43

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SUTX2014-051 07/21/2014

	Rates	Fringes
BRICKLAYER.....	\$ 16.17 **	0.00
CARPENTER.....	\$ 14.15 **	2.42
CEMENT MASON/CONCRETE FINISHER...	\$ 12.46 **	0.00
ELECTRICIAN.....	\$ 18.44	4.53
INSULATOR - MECHANICAL (Duct, Pipe & Mechanical System Insulation).....	\$ 14.04 **	4.79
IRONWORKER, REINFORCING.....	\$ 12.01 **	0.00
IRONWORKER, STRUCTURAL.....	\$ 15.04 **	4.34
LABORER: Common or General.....	\$ 9.20 **	0.00
LABORER: Mason Tender - Brick...	\$ 10.00 **	0.00
LABORER: Mason Tender - Cement/Concrete.....	\$ 10.89 **	0.96
LABORER: Pipelayer.....	\$ 11.00 **	3.47
LABORER: Roof Tearoff.....	\$ 10.06 **	0.00
OPERATOR: Backhoe/Excavator/Trackhoe.....	\$ 14.04 **	1.01

OPERATOR: Bobcat/Skid Steer/Skid Loader.....	\$ 13.93 **	0.00
OPERATOR: Bulldozer.....	\$ 18.29	1.31
OPERATOR: Drill.....	\$ 16.22 **	0.34
OPERATOR: Forklift.....	\$ 14.83 **	0.00
OPERATOR: Grader/Blade.....	\$ 13.07 **	0.00
OPERATOR: Loader.....	\$ 12.87 **	0.70
OPERATOR: Mechanic.....	\$ 17.00 **	0.00
OPERATOR: Paver (Asphalt, Aggregate, and Concrete).....	\$ 16.03 **	0.00
OPERATOR: Roller.....	\$ 12.70 **	0.00
PAINTER (Brush, Roller, and Spray).....	\$ 11.27 **	0.00
PIPEFITTER.....	\$ 15.22 **	3.16
ROOFER.....	\$ 11.42 **	0.00
SHEET METAL WORKER (HVAC Duct Installation Only).....	\$ 18.40	2.12
SHEET METAL WORKER, Excludes HVAC Duct Installation.....	\$ 21.13	6.53
TILE FINISHER.....	\$ 11.22 **	0.00
TILE SETTER.....	\$ 12.15 **	0.00
TRUCK DRIVER: Dump Truck.....	\$ 12.39 **	1.18
TRUCK DRIVER: Flatbed Truck.....	\$ 19.65	8.57
TRUCK DRIVER: Semi-Trailer Truck.....	\$ 12.50 **	0.00
TRUCK DRIVER: Water Truck.....	\$ 12.00 **	4.11

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

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 \*\* Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$17.20) or 13658 (\$12.90). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

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 <https://www.dol.gov/agencies/whd/government-contracts>.

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) (iii)).

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

#### Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

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

#### Survey Rate Identifiers

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

these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

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

#### Union Average Rate Identifiers

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

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

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#### WAGE DETERMINATION APPEALS PROCESS

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

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

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has 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"

SECTION 4  
INSPECTION BY CITY

**PROJECT: South Laredo Wastewater Treatment Plant Blower Building Enclosure Project**

The work covered by these Specifications shall at all times be subject to inspection by the City of Laredo (City) authorized inspectors.

The Contractor shall furnish the City Inspector with every reasonable facility for ascertaining whether the work performed is substandard and deviates from the requirements of the plans and specifications. The City Inspector shall have the authority to halt the construction of any portion of the work not meeting requirements until such time as said work has been corrected to the satisfaction of the Inspector and the Engineer.

City's normal working hours are Monday through Friday from 8:00 A.M. to 5:00 P.M. The contractor shall notify the City at least twenty-four (24) hours in advance for any work that is to be scheduled beyond the limits of the City's working hours, and the Contractor shall not begin any such work scheduled unless proper inspection and/or testing has been pre-arranged with the City, with the cost for such inspection beyond the City's working hours borne by the Contractor. City inspector OT rate is \$66.47 per hour.



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SECTION 5

PROJECT SIGN

The general contractor shall erect two (2) signs, unless otherwise noted by the City Engineer, at the project site identifying the project and indicating that the City of Laredo is participating in the development of the project.

The project signs shall be substantially in accordance with the drawing printed on the following page and shall be made from  $\frac{3}{4}$  inch plywood, placed in a prominent location and maintained in good condition until completion of the project. No separate payment will be made for the signs.

**THE CONTRACTOR SHALL REMOVE AND DISPOSE OF THE PROJECT CONSTRUCTION SIGN WHEN THE WORK HAS BEEN COMPLETED.**

**CITY OF LAREDO, TEXAS**

**SOUTH LAREDO WASTEWATER TREATMENT PLANT  
BLOWER BUILDING ENCLOSURE PROJECT**



Honorable Dr. Victor D. Trevino  
Mayor

Gilbert Gonzalez                      Council Member  
Daisy Campos Rodriguez          Council Member  
Melissa R. Cigarroa                  Council Member  
Alberto Torres, Jr.                    Council Member

Ruben Gutierrez, Jr.                  Council Member  
Dr. David Tyler King                  Council Member  
Vanessa Perez                          Council Member  
Alyssa Cigarroa                        Council Member

Joseph Neeb, City Manager  
(956) 791-7398

Walter (Buzz) Pishkur, Utilities Director  
(956) 721-2000

A/E's Name  
Address  
City, State, Zip Code  
Telephone Number  
Fax Number

Contractor's Name  
Address  
City, State, Zip Code  
Telephone Number  
Fax Number

NOTE:                      Signs are to be installed in ground on 4" x 4" posts  
                                  Blue borders  
                                  White background  
                                  Red letters  
                                  Two (2) project signs are required - 4' x 8'

**CONTRACTOR TO REMOVE SIGNS UPON COMPLETION OF PROJECT**

SECTION 7

ILLEGAL DUMPING

The Contractor or his/her subcontractors shall not dispose of any material whatsoever taken from the project site onto any areas not considered to be legal dump sites. Materials such as broken concrete, asphalt, rebar, trash, etc. are to be disposed of properly, i.e. at the city landfill or as directed by the City Engineer. Unless otherwise noted, no material, including dirt, is to be dumped or placed into an existing creek or channel.

The Contractor is hereby instructed to contact John Porter, CFM at the City Environmental Services Department at (956) 794-1650 for additional information on illegal dumping city ordinances.

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## SECTION 1

### DEFINITION OF TERMS

C-1.01 Definition of Terms: Whenever the terms defined herein occur on the Plans, in any other Documents or instrument herein contemplated or to which the Specifications apply, the intent and meaning shall be as follows:

C-1.02 Owner: (Or Party of the First Party): The individual, firm, corporation or the political subdivision for whom the facilities covered by these Plans and Specifications are to be constructed.

C-1.03 Contractor: (Or Party of the Second Party): The individual, firm or corporation with whom the Contract is made by the Owner.

C-1.04 Engineer: City Engineer employed by the Owner, or such other Engineer, or Supervisor authorized by the City Engineer or the Owner to act on their behalf.

C-1.05 Consultant: Licensed Engineer or Architect employed by the Owner and authorized by the City Engineer or the Owner to act on their behalf. The decisions by the City Engineer are final.

C-1.06 Bidder: An individual, firm or corporation submitting a proposal.

C-1.07 Superintendent: An authorized representative of the Contractor.

C-1.08 Inspector: An authorized representative of the Owner and Engineer.

C-1.09 Laboratory: A testing laboratory approved by the Owner and Engineer.

C-1.10 Contract: The Agreement between the Owner and the Contractor covering the furnishing of all materials and labor necessary to complete the work and consisting of the Plans and Specifications, together with such supplemental agreements as may be made from time to time.

C-1.11 Working Day: A "Working Day" is defined as any day not including Saturdays, Sundays, or any legal holidays observed by the City of Laredo, in which weather or other conditions, not under the control of the Contractor, will permit construction of the principal units of work for a continuous period of not less than seven (7) hours. If the contractor opts to work on Saturday, Sunday, or legal holiday requiring construction inspection, said days are considered working days and charged to the contract time.

C-1.12 Work: All structures, services, machinery, equipment, or other facilities that are described in the Plans and Specifications together with such additions or modifications as may be ordered by the Owner from time to time.

C-1.13 Work Order, or Notice to Proceed: A document authorized by the Owner and issued by the Engineer directing the Contractor to proceed on all or part of the work and a specified date.

C-1.14 Change Order: A supplemental agreement adding to or modifying the Contract, including such additional Plans and Specifications as necessary to properly describe the required change.

C-1.15 Surety: The corporate body which is bound with the Contractor for the faithful performance of the work covered by the Contract.

C-1.16 Plans: The drawings published by the Engineer showing the locations, character, dimensions and details of the work which are part of the Contract. If there is conflict between Plans and Specifications, the more stringent requirement will prevail.

C-1.17 Specifications: The directions, provisions and requirements contained herein pertaining to the method and manner of performing the work, or to the quantities, or to the qualities of materials to be furnished under the Contract. The term "Specifications" shall be deemed to include all Contract Documents, the Special Provisions, the General Provisions, and the Technical Provisions as contained herein, together with all supplemental agreements and change orders. Specifications are part of the Contract. If there is conflict between Plans and Specifications, the more stringent requirement will prevail.

C-1.18 Calendar Days: A "Calendar Day" is defined as any day of the week inclusive of Saturdays, Sundays, and legal holidays.

C-1.19 Totally Complete and Ready for Final Payment: All work is completed, including "punch list" items, all job closeout paperwork has been submitted and approved, and nothing remains except Final Payment to the Contractor.

C-1.20 Substantial Completion: The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part thereof) can be utilized by the Owner for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

## SECTION 2

## DEFINITION OF ABBREVIATIONS

C-2.01 Definitions of Abbreviations: Whenever the abbreviations defined herein occur on the Plans, in the Specifications, Contract, Bonds, Advertisement, Proposal, or in any other Instrument herein contemplated or to which the Specifications apply or may apply, the intent and meaning shall be as follows:

AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
Am. or Amp.	Ampere
Asph.	Asphalt
Ave.	Avenue
B-B	Back to Back
B & S	Bell and Spigot
BM	Bench Mark
Blvd.	Boulevard
BTU	British Thermal Unit
CCC	Center to Center
C/G	Curb & Gutter
CFM	Cubic Feet per Minute
CI	Cast Iron
CL	Center Line
CM	Circular Mil
CO	Cleanout
Con. Or Conc.	Concrete
Cond.	Conduit Minute
Corr.	Corrugated
Cu.	Cubic
Culv.	Culvert
DS	Double Strength
Dia.	Diameter
Dr.	Driveway
Elev. Or El.	Elevation
F.	Fahrenheit
Ft. or ’	Foot or Feet
Gal.	Gallon
HP	Horsepower
In. or ”	Inch or Inches
v.I.P.	Iron Pin
KW	Kilowatt
KVA	Kilovolt
Lin.	Linear
Lb. Or #	Pound
MH	Manhole
Max.	Maximum
Min.	Minimum



Mono.	Monolithic
No.	Number
PL	Property Line
R.	Radius
RCSDP	Reinforced Concrete Storm Drain Pipe
ROW or R of W	Right of Way
RPM	Revolutions per minute
Rein.	Reinforced or reinforcing
Rep.	Replace
SD	Storm Drain
SOP	Secretaria de Obras Publicas (Mexican Secretaries of Public Works)
SS	Sanitary Sewer
Sq.	Square
Std.	Standard
THD	Texas Highway Department
TX DOT	Texas Department of Transportation
V	Volt
VCP	Vitrified Clay Pipe
VG	Valley Gutter
Vol.	Volume
Yd.	Yard
%	Percent

## SECTION 3

## INSTRUCTIONS TO BIDDERS

C-3.01 Examinations of Plans, Specifications, Special Provisions and Site Work: Submission of a Proposal shall constitute prima facie evidence that the Bidder has carefully examined the site of the proposed work, the Proposal, Contract Forms, Plans and Specifications, and has satisfied himself as to the character, quality, and quantity of work to be performed, materials to be furnished, and as to the requirements of these Specifications, Special Provisions, and Contract.

Any information on the Plans and Specifications as to the soil, or material borings, or tests of existing materials, or location of existing utilities is for the convenience of the Bidder. The accuracy of the information is not guaranteed, and no claims for extra work or damages will be considered if it is found during construction that the actual conditions or locations vary from those indicated on the Plans or in the Specifications.

C-3.02 Interpretation of Estimates: Any estimate of quantities of work to be done and materials to be furnished in the proposal or on the Plans is given only as a basis of comparison of Proposals and the Award of the Contract. Such estimate is the result of careful calculation and is believed to be correct, but 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 estimate of quantities, or of the character, location or other conditions pertaining to the work. Payment to the Contractor under unit price contracts will be made only for the actual quantities of work performed or materials furnished in accordance with the Plans and Specifications, and it is misunderstood that the quantities may be increased or diminished as hereinafter provided without any way invalidating the unit bid prices.

C-3.03 Preparation of Proposal: The bidder shall submit his proposal on the forms furnished by the Owner. All blank spaces in the proposal form shall be filled in for each and every item for which quantity is given, and the Bidder shall state the price (typed, or written in ink, both in words and numerals for which he proposed to do each item of work. In case of conflict between words and numerals, the words will govern.

The Proposal shall be signed in ink by the person or persons making or authorized to make the bid. If the proposal is offered by an individual, his name and post office address shall be given. If the proposal is offered by a firm or partnership, the name and post office address of each member of the firm or partnership shall be given. If the proposal is offered by a corporation, the name and title of the person signing the Proposal, and the post office address of the corporation shall be given.

Any person signing a Proposal as agent must file with the Owner legal evidence that he has the authority to do so, and that the signature is binding upon the firm or corporation.

C-3.04 Rejection of Proposal: A Proposal showing any alterations of words or figures, erasures, additions not called for, alternate bids not called for, incomplete bids, condition bids, or proposals not accompany by proposal guaranty as required, will be considered as an irregular bid and may be rejected. The Owner reserves the right to waive technicalities as to changes, alterations, or reservations, and to make the award to the best interest of the Owner.

C-3.05 Proposal Guaranty: Each proposal shall be accompanied by a certified check, cashier's check or bid bond in the amount of five (5%) percent of the total amount bid. Checks shall be made payable unconditionally to the Owner.

C-3.06 Delivery of Proposal: Each Proposal must be an original and must be sealed, together with the original proposal guaranty, in an envelope plainly marked with the name of the project as shown on the Notice to Bidders, and the name and address of the Bidder. When submitted by mail, this envelope shall be placed in another envelope addressed as indicated in the Notice to Bidders.

Only those proposals actually in the hands of the designated official at the time set in the Notice to Bidders shall be considered. Proposals submitted by telephone, telegraph or fax, will **NOT** be considered.

C-3.07 Withdrawal of Proposal: A Bidder may withdraw his proposal provided he submits to the official designated to receive bids his request in writing to do so prior to the time set for opening of proposal.

C-3.08 Public Opening of Proposals: Proposals will be publicly opened and read aloud at the time and place set in the Notice to Bidders.

C-3.09 Competency of Bidders: Before any Contract is awarded, the Owner may require the bidder to furnish a complete statement of his financial resources, his experience in similar work, his equipment available for the work proposed, or any other information necessary to establish his competency and reliability as a Contractor.

C-3.10 Disqualification of Bidder: Any of the following causes may be considered as sufficient for the disqualification of the bidder and the rejection of his Proposal:

- More than one proposal for the same work from an individual or corporation under the same or different name.
- Evidence of collusion among Bidders.
- An unbalanced Proposal.
- Failure to submit a unit price for each item of work shown on the Proposal.
- Lack of competency as revealed by the financial statement, experience record, or plant and equipment statement furnished.
- Lack of responsibility as shown by past work judged from the standpoint of workmanship and progress.
- Uncompleted work which, in the judgement of the Owner, might hinder or prevent the prompt completion of additional work if awarded.
- Being in arrears on existing Contracts.
- Having defaulted on previous Contract.

C-3.11 Materials Guaranty: Before any Contract is awarded, the Owner may require the Bidder to furnish a complete statement of the origin, composition or manufacturer of any and all materials proposed to be used in the work, together with samples, which may be subjected to tests to determine their quality and fitness for work.

2517-247787

City of Laredo - South Laredo Wastewater Treatment Plant  
Blower Building Enclosure Project

Division C

**INSTRUCTIONS TO BIDDERS**

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## SECTION 4

## AWARD AND EXECUTION OF CONTRACT

C-4.01 Consideration of Proposals: For the purpose of award, after the proposals are opened and read, the bids considered the most advantageous to the Owner will be carefully studied. The bids will then be compared and the results made public. Until the award of the contract is made, the Owner reserves the right to reject any or all proposals, to waive technicalities, to advertise for new proposals, or to proceed to do the work otherwise when the best interests of the Owner will be thereby promoted.

C-4.02 Award of Contract: Contract will not be awarded until the necessary investigations as to the competency of the low bidder are made. Award of Contract will be made by the Owner, upon recommendation by the Engineer, to the lowest responsible bidder meeting the requirements of the Owner. Award of Contract will be made within ninety (90) days after the opening of proposals, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

C-4.03 Return of Proposal Guaranties: As soon as the proposal price has been compared, the Engineer may, at his discretion, return the proposal guaranties accompanying those proposals which, in his judgement, will not be considered in making the award. When the award is made, the successful bidder's proposal guaranty only will be retained until after Contract and Bond have been executed.

C-4.04 Performance and Payment Bond: Within ten (10) days after the Notification of Award of Contract, the successful bidder shall execute and file with the Owner a separate surety and payment bond as required by Chapter 93 of the Acts of the Regular Session of the 56<sup>th</sup> Legislature of Texas, in the full amount of the contract price as a guarantee of the faithful performance of the Contract and payment of all obligations which may be incurred for material and labor used in the work. Bonds shall be executed by a surety company authorized to do business in the State of Texas on the bond form provided in these Documents. Any surety shall be subject to the approval of the Owner.

C-4.05 Execution of Contract: Within ten (10) days after Notification of Award of Contract, the successful bidder shall sign and place in the hands of the Owner the necessary Agreement entering into a Contract with the Owner.

C-4.06 Notice to Proceed: The Notice to Proceed will be issued within ten (10) days of the execution of the Agreement by the City provided that the Contractor has properly executed and submitted all Documents required by the City of Laredo within the same period of time. Should there be reasons why the Notice to Proceed cannot be issued within such period, the time may be extended by mutual agreement between the City and Contractor. If the Contractor has submitted all Documents required and the Notice to Proceed has not been issued within the ten (10) day period or within the time extension, the Contractor may terminate the agreement without further liability on the part of either party. Furthermore, should the Contractor fail to execute all the requirements within the same ten (10) days period or within the time extension, the City may terminate the Agreement.

C-4.07: The City of Laredo may make such investigation as it deems necessary to determine the ability of the Bidder to perform the work, the Bidder shall furnish to the City all such information and data for this purpose as the City may request.

C-4.08 Approval of Contract: No Contract will be binding upon the Owner until it has been signed by the Owner and returned to the Contractor.

C-4.09 Failure to Execute Contract: Failure to comply with any of the requirements of these Specifications, to execute Contract within ten (10) days after notification of work, or to furnish surety as required, shall be just cause for the annulment of the award. In case of annulment of award, the proposal guaranty shall become property of the Owner, not as a penalty, but as a Liquidated Damage.

C-4.10: After the Notice to Proceed is issued: The Owner shall provide the Contractor with five (5) complete sets of Plans and Specifications for the Contractor's use during construction. In the case that additional sets are required, the Contractor shall make arrangements to obtain extra sets at his own expense.

C-4.11: Response time during the prosecution of project: The Contractor shall furnish the Owner with three (3) local telephone numbers where the Contractor or responsible representative of the Contractor can be reached at any and all times during the prosecution of this project, and especially during the weekends or holidays. Failure of Contractor to respond to any such emergency which causes City personnel, equipment and materials to be used in such emergency will result in the Contractor being charged an amount which shall be twice the cost incurred by the City in using personnel, equipment and materials to handle such emergency due to failure of the contractor to do so, and, in addition, the Contractor will be charged a penalty of \$ 500.00 for each emergency to which it does not respond. In this connection, "failure to respond" means the failure of the Contractor to respond to telephone calls from relevant staff of Owner.

SECTION 5  
SCOPE OF WORK

C-5.01 Intent of Plans and Specifications: It is the intent of the Plans and Specifications to describe the complete work to be performed under this Contract. Except as provided on the Plans or in the Specifications, it is also the intent that the Contractor shall furnish all materials, supplies, tool, equipment, labor and incidentals necessary to complete the work.

C-5.02 Changes and Increased or Decreased Quantities of Work: The Owner has the right to make such changes and alterations in the Plans or in the quantities of work as he may consider necessary or desirable, and such changes and alterations shall not be considered as a waiver of any condition of the Contract, nor shall they invalidate any provision thereof. The Contractor shall perform the work as increased or decreased, and no allowances will be made for anticipated profits.

Payment to the Contractor will be made for the actual quantities of work done and materials furnished at the unit prices as set forth in the Contract, except as follows:

- a. When the total cost of work to be done, or of materials to be furnished, is more than one hundred and twenty five (125) percent of the total contract price for the item stated in the Proposal, then either party to the Contract, upon demand, shall be entitled to a revised consideration on that portion of the work above one hundred and twenty five (125) percent of the total contract price stated in the Proposal.
- b. When the total cost of work to be done, or of materials to be furnished, is less than seventy-five (75) percent of the total contract price for the item stated in the Proposal, then either party to the Contract, upon demand, shall be entitled to a revised consideration on the work actually done.
- c. Revised consideration shall be determined by supplemental agreement between the parties, which supplemental agreement shall be included with, and shall become a part of, the Contract.

C-5.03 Omitted Items: The Owner may, in writing, order the omission from the work of any item found unnecessary to the project. Such omission shall be subject to all provisions of Par. C-5.02.

C-5.04 Extra Work: When the proper completion of the project requires work for which no quantities or prices were shown in the Proposal, such work shall be called "EXTRA WORK" and shall be performed by the Contractor when so directed in writing by the Owner. "EXTRA WORK" shall be performed in accordance with these Specifications and as may be directed by the Engineer.

Prices for extra work shall be itemized and covered by a supplemental agreement submitted by the Contractor and approved by the Owner prior to the starting of such work.

Claims for extra work not authorized in writing by the Owner prior to the performance thereof will be rejected.

C-5.05 Maintenance of Traffic: When the work requires partial or complete closing of any driveway, alley, street, or roadway, the Contractor shall so schedule and prosecute his work that traffic will be hindered to a minimum.



C-5.06 Removal and Disposal of Structures and Obstructions: All structures and/ or obstructions on the site of the work, which are not to remain in place or which are not to be used in the new construction shall be moved as directed by the Engineer. Such items of removal not listed in the Proposal will not be paid for as separate items; the cost of doing such work shall be included in the unit price bid for other items.

C-5.07 Tools and Accessories: When special wrenches, gauges, or other special tools or accessories are required to properly maintain and operate any machine or equipment furnished under this Contract, the furnishing of such tool and accessories shall be deemed to have been included in the Contract and they shall be furnished by the Contractor without extra cost to the Owner.

C-5.08 Guarantees: All structural, mechanical and electrical equipment or instruments shall be guaranteed against mechanical and physical defects, leakage, breakage, or other damage occurring during normal operation for a period of one (1) year unless otherwise specified in the individual specification sections after all such equipment or instruments have been substantially completed. The Contractor shall promptly repair or make good at his own expense, any defect in such equipment or instruments.

C-5.09 General Guarantee: All work included in the Contract shall be guaranteed against faulty material or workmanship for a period of one (1) year unless otherwise specified in the individual specification sections after all the work has been substantially completed.

Neither final acceptance of the work nor final payment thereof, nor occupancy and use of the work by the Owner shall constitute a waiver of the Owner's right to require the Contractor to repair or make good any such faulty material or workmanship.

C-5.10 Final Cleaning Up: Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, tools, and materials and shall dispose of all rubbish, temporary structures, and surplus backfill. The site shall be left in a neat and presentable condition throughout. Any land area, driveway, sidewalk, alley, street or road (concrete or asphalt) which has been cut or disturbed during the prosecution of the work shall be repaired at the Contractor's expense to a condition at least as good or better than originally existed.

C-5.11 Existing Structures: The Plans show the locations of all known surface and subsurface structures. However, the exact location of gas mains, water mains, conduits, sewer, etc., is unknown and the Owner assumes no responsibility for failure to show any of these structures on the Plans or to show them in their exact location. It is mutually agreed such failure will not be considered sufficient basis for claims for additional compensation for extra work or for increasing the pay quantities in any manner whatsoever, unless the obstruction encountered necessitates, or requires, the building of special work, provision for which is not made in the Plans and Proposal, in which case the provisions in these Specifications for extra work shall apply.

## SECTION 6

## CONTROL OF WORK AND MATERIALS

C-6.01 Authority of Engineer: The work will be observed, tested and inspected by the Engineer, and performed to his satisfaction, in accordance with the Contract, Plans and Specifications. The Engineer will decide all questions which may arise as to the quality and acceptability of materials furnished and work performed, as to the manner of performance and rate of progress of said work, as to the interpretation of the Plans and Specifications relating to the work, as to the fulfillment of the contract on the part of the Contractor and to the rights of different Contractors on the project.

The decision of the City Engineer will be final.

C-6.02 City Engineer as Referee: The City Engineer will act as referee in all questions, arising under the terms of the Contract thereto, and his decisions shall be final and binding.

C-6.03 Adequacy of Design: It is understood that the Owner selected the Engineer to prepare the Plans and Specifications, and all supplements thereto, and it is agreed that the Owner will be responsible for the adequacy of the design, sufficiency of the Plans and Specifications, and safety of structures, provided the Contractor has complied with said Plans and Specifications, all modifications thereof, and additions and alterations thereto approved by the Engineer. The burden of proof shall be upon the Contractor to show that he fully complied with the Plans and Specifications, all modifications thereof, and all additions and alterations thereto.

C-6.04 Plans: Plans will show the lines, grades, cross sections, details and general features of the work. Where shop drawings or working drawings are required, they shall be furnished by the Contractor and approved by the Engineer. Authorized alterations to the Plans will be endorsed on approved copies of the Plans or shown on supplementary sheets.

The approval by the Engineer of the Contractor's shop drawings or working drawings will not relieve the Contractor of any responsibility under the Contract.

The Contractor shall furnish the Engineer with such blueprint copies of shop drawings or working drawings as may be required for approval and for the purposes of supervision.

The contract price shall include the cost of furnishing all such prints.

C-6.05 Conformity with Plans: The finished work shall conform with the lines, grades, cross sections, details and dimensions shown on the Plans. Such deviations from the Plans as may be required will, in all cases, be determined by the Engineer and authorized in writing.

C-6.06 Coordination of Plans and Specifications and Supplemental Agreements: The Plans, Specifications, and supplemental agreements are essential parts of the Contract, and a requirement occurring in one is as binding as though occurring in all. In case of disagreement, Plans shall govern over "Technical Provisions" and "Special Provisions" shall govern over "Technical Provisions". The Contractor shall not take advantage of any apparent error or omission on the Plans or Specifications. In the event the Contractor discovers any apparent error or discrepancy, he shall immediately call upon the Engineer for his interpretation and decision, and such decision shall be final.

C-6.07 Cooperation of Contractor: The Contractor shall give the work the constant attention necessary to facilitate the progress thereof and shall cooperate with the Engineer and with other Contractors in every way possible.

The Contractor shall have on the work at all times, a satisfactory and competent English-speaking Superintendent, authorized to receive orders, and act for him as his agent. The Contractor shall designate to the Engineer in writing the name of the Superintendent, and the designated Superintendent may not be removed from the work without the written permission of the Engineer.

C-6.08 Construction Stakes: The Contractor shall provide survey control point coordinate data and project bench mark, as required for completing the project.

Any missing construction stakes which have been destroyed by the different utility companies, vandals and/or the Contractor at the time of construction will be replaced by the Contractor at his own expense.

The Engineer may, at his option, make spot or complete checks on all construction alignment and grades to determine the accuracy of the Contractor's survey work. These checks, however, will not relieve the Contractor of his responsibility of constructing the work to the lines and grades as shown on the plans or approved change orders.

C-6.09 Quantities of Materials: It shall be the responsibility of the Contractor to verify all quantities of materials shown on the Plans before ordering such materials. Payment is provided for acceptable materials, and materials rejected due to improper fabrication or excess quantity or other reasons within the control of the Contractor will not be paid for regardless of the quantities or dimension shown on the Plans.

C-6.10 Approval of Materials: All materials provided shall be new and in compliance with the specifications provided. The sources of supply of materials shall be subject to the approval of the Engineer. Representative samples of materials proposed shall be submitted, if required, for examination and testing by an independent testing laboratory selected by the City.

Results obtained from testing such samples may be used for preliminary approval, but will not be used as final acceptance of materials. All materials proposed for use may be inspected or tested at any time during their preparation or use.

If at any time, it is found that sources of supply which have been approved do not furnish a product of uniform quality, or if the product becomes unacceptable at any time, the Contractor shall furnish approved material from another source.

Any material, which after approval has for any reason become unfit for use, shall not be incorporated into the work.

C-6.11 Samples and Tests: Samples and testing procedures shall conform to the requirements of appropriate designations of the American Association of State Highway Officials or the American Society for Testing Materials.

Test for determining the fitness of materials; tests for the purpose of obtaining preliminary approval of materials; tests for determining concrete mixes will be at the expense of the Contractor. Tests for the actual control of the work, such as soil compacting tests and concrete compressive strength test, will be at

the expense of the Owner. Any and all retesting because of failure in soil compaction or concrete compressive strength tests shall be done at the expense of the Contractor. Tested and accepted subgrade shall be primed and cured and shall be covered and protected with the flexible base or asphalt stabilized base (black base) within a maximum of seven (7) days. Tested and accepted flexible base shall be primed and cured a minimum of seventy-two (72) hours and shall be covered with asphalt within seven (7) days. Failure to comply with the seven (7) days limitations may result in the need for re-testing at the discretion of the Engineer. Black base shall be tacked before being covered with asphalt. The Contractor shall provide such facilities as the Engineer may require for conducting field tests and collecting and forwarding samples. All sampling and testing shall be under the control of the Engineer and shall be done in laboratories approved by him.

**C-6.12 Storage:** Materials shall be stored as to insure the preservation of the quality and fitness for the work. Material, which is not, in the opinion of the Engineer, properly stored and protected will not be included as material on hand in the estimates.

**C-6.13 Authority and Duties of Inspectors:** Inspectors employed by the Owner shall be authorized to inspect all work done in any part of the project and all preparation, fabrication, or manufacture of materials to be used.

The Inspector shall be authorized to call to the attention of the Contractor any failure of the work or materials to conform to the Specification or the Plans. He will in no case act as foreman or perform other duties for the Contractor, nor shall he interfere with the management of the work. In the event the Contractor does not comply with the requirements of the Owner and Engineer, he may stop all work until the non-compliance is corrected.

If the progress of the work becomes unduly delayed because of negligence on the part of the Contractor, the Inspector shall notify the Owner and the Engineer, who may require the Contractor to give reasons for the delay. If it is found that the Contractor is at fault, then it is the prerogative of the Owner to demand correction.

Inspection as provided herein shall not relieve the Contractor from any obligation to perform the work in conformity with the requirements of the Plans and Specifications. No Inspector shall be authorized to revoke, alter, enlarge or release any requirements of the Plans and Specifications, or to issue instructions contrary to the Plans and Specification, or to approve or accept any portion of the work.

The Contractor shall furnish every reasonable facility for ascertaining whether or not the work is performed in accordance with the Plans and Specifications.

No backfill shall be made unless inspected by the Engineer or the City's representative designated in writing and verbal approval of field Engineer is given to such work; if the Contractor should backfill any work without such inspection and approval, the Contractor shall remove or uncover such portions of the finished work as may be directed. After examinations, the Contractor shall restore said portion of the work to the standard required by the Plans and Specifications. Should the work thus exposed and examined prove acceptable or unacceptable, the uncovering or removing and the replacing of the covering or making good of the parts removed shall be done at the Contractor's expense.

**C-6.14 Suspension of Work:** In case of any dispute arising between the Contractor and the Inspector as to materials furnished or the manner of performing the work, the Inspector shall have the authority to reject materials or suspend work until the question at issue can be referred to and decided by the Engineer.

If the Contractor refuses to suspend work on verbal order, the Inspector shall issue a written order to suspend work giving the reason for suspension. After placing the order in the hands of the Contractor's man in charge, the Inspector shall immediately leave the job. Work done during the absence of the Inspector will not be paid for.

**C-6.15 Removal of Defective and Unauthorized Work:** All work which has been rejected or condemned shall be repaired or removed and replaced as the Engineer may direct, at the expense of the Contractor. Materials not conforming to the requirements of the Plans and Specification shall be removed immediately from the site of the work and replaced with satisfactory material at the expense of the Contractor.

Work done without lines and grades, work done beyond the lines and grade shown on the Plans, work done without inspection, or any extra or unclassified work done without written authority and prior agreement in writing as to the prices will be done at the Contractor's risk and will be considered unauthorized. At the option of the Engineer, such work may not be measured and paid for, or may be required to be removed and replaced at the expense of the Contractor.

Upon failure of the Contractor to repair satisfactorily or to remove and replace rejected, unauthorized, or condemned work or materials immediately after receiving formal notice from the Engineer, the Owner may at his own option:

- a. Recover for such defective work or materials on the Contractor's bond, or;
- b. Recover from such defective work or materials by action in a court having proper jurisdiction in such matter, or;
- c. Employ labor and equipment and satisfactorily repair, or remove and replace, such defective work or materials and charge the cost of the same to the Contractor, which cost will be deducted from any money due him.

**C-6.16 Disputed Claim for Extra Work:** In case the Contractor deems extra work compensation is due to him for work or materials not clearly covered in the Contract, or not covered by the Engineer as "EXTRA WORK", the Contractor shall notify the Engineer in writing of his intention to make claim for such extra compensation before he begins the work on which he bases the claim and shall afford the Engineer every facility for keeping actual cost of the work.

Failure on the part of the Contractor to give such notice or afford the Engineer every facility for keeping account of actual cost of the work shall constitute waiver of the claim for extra compensation. The filing of such notice by the Contractor and the keeping of cost by the Engineer shall not in any way be construed to prove the validity of the claim. When the work has been completed, the Contractor shall within ten (10) days file claim for extra compensation with the Engineer, who will present it to the Owner for consideration.

**C-6.17 Substantial Completion:**

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is Substantially Complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a

Certificate of Substantial Completion. Promptly thereafter, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reason therefor. If Engineer considers the Work substantially complete, Engineer will prepare and deliver to the Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after the receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will within 14 days after submission of the tentative certificate to Owner notify Contractor in writing, stating reasons therefor. If, after consideration of Owner's objection, Engineer considers the Work substantially complete, Engineer will within said 14 days execute and deliver to Owner and Contractor a definitive Certificate of Substantial Completion (with revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless the Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

- B. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion, but the Owner shall allow Contractor reasonable access to complete or correct items on the tentative list.

C-6.18 Partial Utilization:

- A. Use by Owner at Owner's option of any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which the Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by the Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following conditions.
1. Owner at any time may request Contractor in writing to permit Owner to use any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Engineer that such part of the Work is substantially complete and request Engineer to issue a Certificate of Substantial Completion for that part of the Work. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a Certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to

be substantially complete, Engineer will notify Owner and Contractor in writing giving reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of paragraph 6.17 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto. However, the project warranty (guarantee) will not begin until all work has reached substantial completion.

2. No occupancy or separate operation of part of the Work may occur prior to compliance with the applicable requirements regarding property insurance.

#### C-6.19 Final Inspection

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

## SECTION 7

### LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC

C-7.01 Laws to be Observed: The Contractor shall make himself familiar with and shall observe and comply with, all Federal, State, and local laws, ordinances and regulations which in any manner affect the conduct of the work, and shall indemnify and save harmless the Owner and the Owner's representative against any claim arising from the violation of any such law, ordinance, or regulation whether by himself or by his employees.

C-7.02 Permits and Licenses: The Contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary to the due and lawful prosecution of the work.

C-7.03 Patented Devices, Materials and Processes: If the Contractor is required or desires to use any design, device, material or process covered by letters, patent, or copyright, he shall provide for such use by suitable legal agreement with the patentee or owner of such patent. The Contractor and his surety shall indemnify and save harmless the Owner 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 in connection with the work agreed to be performed under this Contract, and shall indemnify the Owner for any costs, expenses, and damages which it may be obliged to pay for reasons of any such infringement at any time during the prosecution, or after the completion of the work.

C-7.04 Public Safety and Convenience: The safety of the public and the convenience of traffic shall be regarded as of prime importance during construction and provisions thereof, made necessary by the work, shall be the direct responsibility of the Contractor, and shall be performed at his own expense.

Where the Contractor is required to construct temporary crossings for streams, culverts, ditches or trenches, his responsibility for accidents shall include the approaches as well as the structures of such crossing.

C-7.05 Sanitary Provisions: The Contractor shall, at his own expense, provide and maintain in a neat, sanitary condition such accommodations for the use of his employees as may be necessary to comply with the requirements of the Texas Natural Resource Conservation Commission and of other authorities having jurisdiction.

C-7.06 Barricades and Warning Signs: Contractor shall furnish and maintain adequate barricades, warning and directing signs, red flags, lights and other traffic control devices as are necessary to comply with the latest edition of the TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREET S AND HIGHWAYS.

All provisions of barricades and warning signs shall be considered an incidental and necessary part of the work and no direct payment will be made therefor. All costs of providing such safeguards shall be included in the prices bid for other parts of the work.



C-7.07 Use of Explosives: When the use of explosives is necessary in the prosecution of work, the Contractor shall use the utmost care not to endanger life or property. All explosives shall be stored in a secure manner and all storage places shall be marked clearly with the words “DANGEROUS EXPLOSIVES”. The method of storing and handling explosives and highly inflammable materials shall conform to the requirements of Federal and State laws and regulations. The Contractor shall not use any explosives until he has taken the legal precautions necessary to save harmless the Owner from any claims arising from such use of explosives.

C-7.08 Protection and Restoration of Property: The Contractor shall take all measures necessary to protect public or private property which might be injured by any process of construction, and in case of any injury or damage to said property, he shall restore at his expense the damaged property to a condition similar or equal to the existing before such injury damage was done, or he shall make good such injury or damage in an acceptable manner.

Where the work involves excavation of any public or private driveway, alley, street or roadway, the Contractor shall do any work necessary to restore such driveway, alley, street or roadway to a condition similar or equal to that existing before such work was done. The Contractor shall be responsible for any subsidence of backfill or pavement failure due to such excavation and shall promptly repair any such subsidence or failure.

C-7.09 Protection of Existing Utilities: The Contractor shall contact the utility company for exact location prior to doing any work that might interfere with or damage present utilities.

The Contractor shall take all measures necessary to protect existing surface drains, sewers, underdrains, conduits, utilities, or similar underground structures, and to provide temporary service when service in any of these is interrupted.

When such facilities are encountered, the Contractor shall notify the Engineer who will arrange for their removal, if necessary. Any utility lines cut or damaged shall be repaired and restored to working conditions as determined by the Engineer.

C-7.10 Responsibility for Damage Claims: The Contractor shall save harmless the Owner from all suits, action in or claims brought on account of any injuries, or damages sustained by any person or property in consequence of any neglect in safeguarding the work by the Contractor; or on account of any claim or amount recovered for any infringement of patent, trademark, or copyright; or for any claims or amounts arising or recovered under the “Workmen’s Compensation Laws” or any other laws. He shall be held responsible for all damage or injury to property of any character occurring during the prosecution of the work resulting from any omission, neglect, or misconduct on his part in the manner or method of executing the work, or from defective work or materials.

C-7.11 Responsibility for the Work: Until acceptance of the work by the Engineer, in writing, it shall be under the charges and care of the Contractor. The Contractor shall rebuild and make good at his own expense all injuries and damage to the work occurring before its completion and acceptance. In case of suspension of work for any cause, the Contractor shall be responsible for the preservation of all materials.

C-7.12 Use of Completed Work: Whenever, in the opinion of the Engineer, any portion of the work is in acceptable conditions, it may be entered upon and used by the Owner upon the written order of the Engineer. Such use shall be held an acceptance of that portion of the work, but not be considered as a waiver of any of the provisions of these Specifications. Pending final completion and acceptance of the entire work, all necessary repairs and renewal of any part of the work so used, due to defective material or work, to natural causes other than wear and tear, or to the operations of the Contractor, shall be performed by the Contractor at his own expense.

C-7.13 No Waiver of Legal Right: Inspection by the Engineer, or by any of his duly authorized representatives, any order, measurement, or certificate by the Engineer; any order by the Owner for the payment of money, any payment for or acceptance of any work, or extension of time; or any possession taken by the Owner shall not operate as a waiver of any provision of the Contract, or any power therein preserved to the Owner, or of any right to damages therein provided. Any waiver of any breach of the Contract shall not be held to be a waiver of any other subsequent breach.

The Owner reserves the right to correct any error that may be discovered in any estimate that may have been paid, and to adjust that or any subsequent estimate to meet the requirements of the Contract. The Owner reserves the right to claim and recover sums as may be sufficient to correct any error or make good any deficit in the work resulting from error, dishonesty, or collusion in the work after the final payment has been made.

C-7.14 Responsibilities of Parties as to Utility Work: It shall be the responsibility of the Contractor to check and coordinate his work with the public and private utility companies which have authority from the City of Laredo to own and operate lines, pipes, conduits, or other means of conveyance within the streets' right-of-way. The Contractor shall contact the Engineer concerning any and all utility relocation work need, and it shall be the responsibility of the Contractor to advise the Engineer of any lines or utility poles to be relocated. The Engineer shall assist in coordinating the various utility relocation activities, but shall not be responsible for any delays occasioned by this work, although appropriate allowance for additional contract time will be made by the Engineer if warranted. The Owner shall not be responsible for any acts of the Contractor or any damages resulting from work done by the Contractor relating to the removal, alteration, or other activity concerning utilities.

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## SECTION 8

## PROSECUTION AND PROGRESS

C-8.01 Right-of-way: The Owner will furnish all land or right-of-way necessary for the performance of the contract and will use due diligence in acquiring land or right-of-way. Should all necessary land or right-of-way not be acquired prior to beginning of construction, the Contractor shall begin with the work upon such land or right-of-way as the Owner may have acquired.

C-8.02 Delays Due to Owner: Should the Owner be prevented or enjoined from proceeding with the work or authorizing its prosecution, either before or after its commencement, by reason of any litigation or by reason of the Owner's inability to acquire necessary land or right-of-way, the Contractor shall not be entitled to make or assert any claim for damage by reason of such delay, or to withdraw from the contract except by consent of Owner.

The time for completion of the work will be extended by such time as determined by the Engineer as will compensate for the lost time by reason of said delay.

C-8.03 Subletting or Assigning of Contract: The City does not allow, permit, negotiate, authorize nor approve any assignment of contract proceeds between the City, the Contractor, and/or with the bank, lending institution or any type of financial institution either before, during or after a contract award.

The City agrees to pay the Contractor for specified services as stated in the agreed contract. The City does not agree to pay any additional party either jointly or separately for the contract under discussion.

C-8.04 Subcontracting: The Owner will not recognize any subcontractor on the work. The Contractor shall be fully responsible to the Owner for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them.

C-8.05 Prosecution of Work: Prior to the beginning of the work, the Contractor shall submit to the Engineer such schedules, charts, or briefs as may be required, outlining the manner of prosecution of the work. The Contractor shall begin the work within ten (10) Calendar Days after the date set in the "Work Order" or Notice to Proceed and shall continuously prosecute same with such diligence as will enable him to complete the work within the time specified.

The Contractor shall notify the Engineer at least twenty-four (24) hours prior to the beginning at any point. He shall not begin new portions of the work to the detriment of portions already begun.

***Owner's normal working hours are Monday through Friday, 8:00 am to 5:00 pm.*** The Contractor shall notify the Owner at least twenty-four (24) hours in advance for any work that is to be scheduled beyond the limits of the Owner's working hours, and he shall not begin on such work schedule unless proper inspection by the Contractor has been pre-arranged with the Owner, with the cost for such work beyond the Owner's working hours borne by the Contractor.

If at any time the methods, equipment, or sequence of operations used by the Contractor are found to be inadequate to secure the quality of the work or rate of progress required by the contract, the Engineer may in writing order such modifications in the Contractor's methods, equipment, or sequence of operations as he may deem necessary, and the Contractor shall comply with such order.

C-8.06 Workmen and Equipment: All workmen employed by the Contractor shall be skilled and competent. Any person employed by the Contractor who, in the opinion of the Engineer does not perform his work in a proper and skillful manner or who is disrespectful, intemperate, disorderly, or otherwise objectionable shall at the written order of the Engineer be immediately removed from the work and shall not be employed again on any part of the work without written consent from the Engineer.

The Contractor shall furnish and use such suitable machinery and equipment as may be required in the opinion of the Engineer to properly prosecute the work. The Contractor shall at the written order of the Engineer remove from the work any equipment found unsuited to properly perform the work.

Upon failure of the Contractor to remove from the work any person or equipment as ordered by the Engineer, the Engineer may withhold all estimates which have or may become due or may suspend the work until such orders are complied with.

C-8.07 Temporary Suspension of Work: The Engineer shall have the authority to suspend the work wholly or in part for such period or periods as he may deem necessary due to unsuitable weather, or such other conditions as are considered unfavorable for the prosecution of the work or for such time as is necessary due to failure on the part of the Contractor to comply with orders given or to perform any or all provisions of the contract.

If work is stopped 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, and he shall take every precaution to prevent damage or deterioration of the work performed.

The Contractor shall not suspend the work without written authority from the Engineer and shall proceed with the work promptly when notified by the Engineer to resume operations.

C-8.08 Computation of Contract Time: The Contractor shall complete the work within the number of days stated in the contract. The number of days used shall be the number of days from the first day of actual commencement of operations or the 10<sup>th</sup> day after the date set in the Work Order or Notice to Proceed whichever comes first and counting that day as the first elapsed day of contract time.

If the completion of the contract requires unforeseen work, or work and materials in greater quantities than those set forth in the proposal, then additional days or suspension of time charges will be allowed the Contractor equal to the time which in the opinion of the Engineer the work as a whole is delayed.

C-8.09 Failure to Complete the Work on Time: The time set forth in the proposal for the completion of the work is an essential element of the contract. If the contractor fails to complete the work in the number of Calendar Days specified, Liquidated Damages will be charged for each day thereafter until the work has been satisfactorily completed.

If the Contractor fails to Substantially Complete the work and/or Totally Complete and have ready for Final Payment within the completion dates specified in Division B, Section 1, he agrees to pay Liquidated

Damages as specified in Division B, Section 1. In addition, the Contractor shall meet intermediate milestones as referred to in Division B. Such deductions shall in no way be considered a penalty, but as compensation to the Owner for the added expense to him for engineering supervision and other costs.

C-8.10 Abandonment of Work or Default of Contract: The Engineer may give notice in writing to the contractor and his surety of delay, neglect, or default stating which if the Contractor:

- Fails to begin work within the time specified, or fails to perform the work with sufficient workmen and equipment; or
- Fails to provide materials of sufficient quantity to insure the completion of the work within the contract time; or
- Performs the work unsuitably; or
- Neglects or refuses to remove materials or perform new work such as may have been rejected; or
- Discontinues the work without authority; or
- Refuses to suspend or resume operations when so directed by the Engineer; or
- Becomes insolvent or is declared bankrupt; or
- Commits any act of bankruptcy insolvency; or
- Makes an authorized assignment for the benefit of any creditor; or
- Fails from any other cause whatsoever to carry out the work in an acceptable manner

If a satisfactory effort has not been made by the Contractor or his surety to correct such delay, neglect, or default, during the ten (10) days after such notice is given, the Owner may declare the work abandoned and so notify the Contractor and his surety.

After receiving such notification of abandonment, the Contractor shall not remove from the work any machinery, equipment, tools, materials or supplies then on the site. The Owner shall have the power and authority without violating the contract to take prosecution of the work out of the hands of the Contractor and to appropriate or use any or all materials and equipment on the site as may be suitable and acceptable and enter into an agreement for the completion of the contract according to the terms and provisions thereof, or use such other methods as he may elect for the completion of the contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the work under the contract shall be deducted from any money due or which may become due to the Contractor. In the case the cost to the Owner is less than the amount which would have been payable under the contract if it had been completed by the Contractor, then the Contractor shall be entitled to receive the difference. In case the cost to the Owner exceeds the amount, which would have been payable under the contract, if it had been completed by the Contractor, the Contractor and his surety shall be liable and shall pay the Owner the amount of such excess.

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## SECTION 9 MEASUREMENT AND PAYMENT

C-9.01 Measurement of Quantities: All work completed under the Contract will be measured in United States standard measures. Linear and surface measurements will be taken horizontally unless otherwise shown on the Plans. Structures will be measured to the neat lines shown on the Plans.

When any material is cubic yards in the vehicle, such measurement will be made at the point of delivery. The capacity of each vehicle shall be plainly marked on said vehicle and the capacity of marking shall not be changed without written permission of the Engineer. The Engineer shall have authority to require all vehicles to have uniform capacity.

C-9.02 Scope of Payment: The Contractor shall accept the payment as provided in this Contract as full compensation for furnishing all materials, equipment, tools, labor and incidentals necessary to complete the work and for performing all work contemplated and embraced under this contract, as full compensation for loss or damage arising from the nature of the work, or from action of the elements, or from any unforeseen difficulties which may be encountered during the prosecution of the work; as full compensation for all expenses incurred in the consequence of the suspension or discontinuance of the work; as full compensation for expenses incurred in any infringement of patent, trade-mark, or copyright; and as full compensation for completing the work in conformity with the requirements of the Plans and Specifications. Payment will be made only on items which are complete, in place, tested and accepted by the Owner. Materials on hand shall be considered for payment ONLY when proper PAID invoices are submitted with Contractor's pay estimates. Materials on hand must be placed in a secured area designed for the project under this contract and be available for inspection by the Engineers at all times. The Contractor must provide an inventory of all materials on a form acceptable to the Engineer and which must accompany each pay request. The payment of any partial or current estimate shall in no way affect the obligation of the Contractor at his own cost to repair or renew any defective parts of the construction or to replace any defective materials used in the construction and to be responsible for all damages due to such defects. Any items to complete the work indicated on plan shall be considered subsidiary to included portions of work and no further compensation will be made.

No monies payable under this contract, except the estimate for the first month or period, shall become due and payable until the Contractor shall satisfy the Owner that he has fully settled and paid for all materials and equipment used in or upon the work and labor done in connection therewith and the Owner may if he so elects pay and or all bills wholly or in part, and deduct the amount or amounts paid from any estimate(s) except the first estimate.

In the event the surety on any bond given by the Contractor becomes insolvent or is placed in the hands of a receiver or has its right to do business in the State revoked by Law, the Owner may if he so elects withhold payment of any or all estimates until the Contractor shall give a good and sufficient bond in lieu of the bond so executed by said surety.

C-9.03 Payment for Altered Quantities: When alterations in the Plans or quantities of work not requiring supplemental agreements are ordered and performed and the Contractor shall accept payment in full at the contract price for the actual quantities of work done. No allowance for anticipated profits will be made. Increased or decreased work involving supplemental agreements will be paid for as stipulated in such agreements.



C-9.04 Payment for Omitted Items: When any item is ordered omitted from the Contract, the Contractor shall accept payment in full at the contract price for any work actually performed on such item prior to the date of issuance of such order. No allowance will be made for anticipated profits on work ordered omitted. Acceptable materials ordered by the Contractor or delivered on the work prior to the date of issuance of such order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner. The Contractor shall submit immediately certified statements covering all money expended in the preparation for any item ordered omitted and shall be entitled to reimbursement for any money expended in preparation for any items when such preparation is of no value to the remaining items of the Contract.

C-9.05 Payment for Extra Work: Extra work performed under a supplemental agreement will be paid for according to the terms of such supplemental agreement.

Extra work if performed on a force account basis will be paid for as follows:

- For all labor and foremen, the Contractor will receive the wage paid on the project for each hour that said labor and foremen are actually engaged on such work to which shall be added the actual cost of premium for public liability and workmen's compensation insurance and social security taxes for the actual amount of such payroll.
- For all materials used on such work the Contractor will receive the actual cost of such materials including freight charges.
- For machinery and equipment used on such work the Contractor will receive an agreed rental price for each hour that such machinery and equipment is actually used on such work. The agreed price shall include the cost of fuel, lubrication and repairs.
- To the sum of the foregoing an amount equal to fifteen (15) percent thereof will be added, as compensation for the use of small tools, Superintendent's services, timekeeper's services.
- Premium bond and all other overhead expenses incurred in the prosecution of the extra work, including Contractor's profit.
- The sum of such payments provided for shall be accepted by the Contractor's as full compensation as provided in C-9.02.

C-9.06 Partial Payments: Once a month and within the thirty days after submittal of a correct and complete estimate, the Owner shall make a progress payment on the basis of a duly certified and approved estimate of the work performed during the preceding calendar month under this Contract. To insure the proper performance of the Contract, the Owner shall retain ten (10) percent\*\* of the amount of each estimate until final completion and acceptance of all work covered by this contract.

\*\* Note: Retainage for construction contracts over four hundred thousand dollars (\$400,000) shall be five (5) percent.

In the event that the base bid is less than twenty-five thousand dollars (\$25,000), the total contract price will be paid in one payment upon completion and acceptance of the project.

Should any defective material or work be discovered or should a reasonable doubt arise as to the integrity of any part of the work completed prior to final acceptance and payment, there will be deducted from the first estimate presented after the discovery of such work, an amount equal to the value of the defective or questionable work. The value of such defective work will be deducted from all subsequent estimates until the defects have been remedied or the cause for doubt removed.

C-9.07 Termination of the Contract by the Contractor: If the work is stopped for a period of thirty (30) days under an order of any court or other public authority having jurisdiction, or as a result of an act of government, such as declaration of a national emergency making materials unavailable, through no act or fault of the Contractor or subcontractor or their agents or employees or any other persons performing any of the work under a contract with the Contractor, or if the work should be stopped for a period of thirty (30) days by the Contractor because the Engineer has not issued a Certificate for payment as provided in C-9.06 or because the Owner has not made payment within ten (10) days after such stopping of work, then the Contractor may, upon seven (7) additional days written notice to the Owner and the Engineer, terminate the Contract and recover from the Owner payment for all work executed and for any proven loss sustained upon any materials, equipment and machinery, including reasonable profit and damages.

C-9.08 Termination of the Contract by the Owner: If the Contractor is adjudged bankrupt, or if he makes a general assignment for the benefit of his creditors, or if a receiver is appointed on account of his insolvency, or if he persistently or repeatedly refuses or fails, except in cases for which extension of time is provided, to supply enough properly skilled workmen, or proper materials, or if he fails to make prompt payment to Subcontractors or for materials or labor, or persistently disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, or otherwise is guilty of a substantial violation of a provision of the Contract Documents, then the Owner, upon certification by the Engineer that sufficient cause exists to justify such action, may without prejudice to any right or remedy and after giving the Contractor and his surety, if any, seven (7) days written notice, terminate the employment of the Contractor and take possession of the site and of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor and may finish the work by whatever method he may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the work is finished.

C-9.09: If the unpaid balance of the Contract Sum exceeds the costs of finishing the work, including compensation for the Engineer's additional services made necessary thereby, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or to the Owner, as the case may be, shall be certified by the Engineer, upon application, and this obligation for payment shall survive the termination of the Contract.

C-9.10 Acceptance of Final Payment: When the work provided for in the contract has been completed and the final inspection has been made by the Engineer, and all parts of the work have been approved and accepted, the final estimate showing all sums due the Contractor shall be prepared. All prior partial estimates and payment shall be subject to correction in the final estimate and payment. No payment on the final estimate will be made until the Contractor furnishes satisfactory evidence that all claims growing out of lawful demands of laborers, workmen, mechanics, subcontractors, materialmen, furnishers of machinery and parts thereof, and suppliers of all kinds have been satisfied. Upon final payment the Contractor shall execute a certificate and release upon the Owner on the form specified.

C-9.11 Affidavit of Payment of Debts and Claims and Release of Liens: Each and every pay estimate must be accompanied by an “Affidavit of Payment of Debts and Claims and Release of Liens” form (sample form follows this section).

C-9.12 Materials on Hand Inventory: When materials on hand payment is requested, an “Inventory of Materials on Hand” is required and must be included with Contractor’s Pay Estimate. Proof of payment for materials on hand is also to be included with Materials Inventory. A sample form follows this section

C-9.13 Photographs: The Contractor shall submit with each monthly progress pay estimate four (4) each 3 1/2" x 5" color photographs depicting generally the work done during that month, and each photograph properly identified and dated.

**AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS  
AND RELEASE OF LIENS**

TO: CITY OF LAREDO

PROJECT: South Laredo Wastewater Treatment Plant  
Blower Building Enclosure Project

WEBB COUNTY, TEXAS

By this instrument the undersigned Contractor engaged in the construction of the above project hereby certifies that on this date, or any time prior thereto, except listed below, the Contractor has paid the full or has otherwise satisfied all obligations for all materials and equipment furnished, for all work, labor, and services performed and for all known indebtedness and claims against the undersigned for damages arising in any manner on or against the project, its land, improvements and equipment of every kind.

The undersigned hereby certifies that he has received all payments currently due under this Contract for work on the above referred (except Retainage). Therefore, the undersigned does hereby waive and/or release any and all liens against the property and project as of the \_\_\_\_\_ day of \_\_\_\_\_ ..

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
Typed Signature and Title

STATE OF TEXAS  
COUNTY OF WEBB

Before me, the undersigned authority, on this day personally appeared \_\_\_\_\_ known to me to be the person whose name is subscribed to the foregoing instrument, and being first duly sworn, acknowledged to me that he/she executed the same for the purpose and consideration therein expressed and declared to me that the statements contained herein are true.

SWORN AND SUBSCRIBED TO before me this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_ .

\_\_\_\_\_  
Signature – Notary Public for the State of Texas

\_\_\_\_\_  
Notary Public’s Typed Signature

My Commission expires: \_\_\_\_\_



## CONTRACT CONDITIONS

### 1. PRIVACY OF CONTRACT

NOT USED

### 2. DEFINITION

NOT USED

### 3. PROGRESS AND PAYMENT SCHEDULE

- (a) The Contractor shall submit for approval immediately after execution of the Agreement, a carefully prepared Progress Schedule, showing the proposed dates of starting and completing each of the various sections of the work, the anticipated monthly payments to become due the Contractor, and the accumulated percent of progress each month.
- (b) The following paragraph applies only to contracts awarded on a lump sum contract price:

***COST BREAKDOWN*** - The Contractor shall submit to the Owner a breakdown of his estimated cost of all work to be accomplished under the contract, so arranged and itemized as to meet the approval of the Owner and Engineer. This breakdown shall be submitted promptly after execution of the agreement and before any payment is made to the Contractor for the work performed under the Contract. After approval by the Owner the unit prices established in the breakdown shall be used in estimating the amount of partial payments to be made to the Contractor.

### 4. PAYMENT TO CONTRACTOR

#### (a) Progress Payments

- (1) The Contractor shall prepare his requisition for progress payment as of the last day of the month and submit it, with the required number of copies, to the Engineer for his review. The amount of the payment due to the Contractor shall be determined by adding to the total value of work completed to date, the value of materials properly stored on the site and deducting (1) ten (10%) percent of the total amount, as a Retainage and (2) the amount of all previous payments. The total value of work completed to date shall be based on the estimated quantities of such materials and the invoice prices. Copies of all invoices shall be available for inspection by the Engineer.
- (2) The Contractor shall be responsible for the care and protection of all materials and work upon which payments have been made until final acceptance of such work and materials by the Owner. Such payments shall not constitute a waiver of the right of the Owner to require the fulfillment of all terms of the Contract complete and satisfactory to the Owner in all details.

- (3) The five (5%) percent Retainage of the progress payments otherwise due to the Contractor may not be reduced until the building of the project is Substantially Complete and a reduction in the Retainage has been authorized by the Owner.
- (4) The following clause applies only to contracts where the total price at the Time of Execution is \$400,000 or greater and the Retainage is greater than five (5%) percent.

The Owner shall deposit the retainage in an interest-bearing account, and the interest earned on such Retainage FUNDS shall be paid to the Contractor after completion of the contract and final acceptance.

**(b) Withholding Payments**

The Owner may withhold from any payment otherwise due the Contractor so much as may be necessary to protect the Owner and, if so elects, may also withhold any amounts due from the Contractor to any subcontractors or material dealers, for work performed or materials furnished by them. The foregoing provisions shall be construed solely for the benefit of the Owner and will not require the Owner to determine or adjust any claims or disputes between the Contractor and his subcontractors or material dealers, or to withhold any moneys for their protection unless the Owner elects to do so. The failure or refusal of the Owner to withhold any moneys from the Contractor shall in no way impair the obligations of any surety or sureties under any bond furnished under this contract.

**(c) Payments subject to Submission of Certificates**

Each payment to the Contractor by the Owner shall be made subject to submission by the Contractor of all written certifications required of him and his subcontractors by general or special conditions elsewhere in this contract.

**(d) Final Payment**

- (1) After final inspection and acceptance by the Owner of all work under the contract, the Contractor shall prepare his requisition for final payment which shall be based upon the carefully measured or computed quantity of each item of work at the applicable unit prices stipulated in the Agreement or cost breakdown (*if lump sum*), as adjusted by approved change orders. The total amount of the final payment due the Contractor under this contract shall be the amount computed as described above less all previous payments. Final payment to the Contractor under this contract shall be the amount computed as described above less all previous payments. Final payment to the Contractor shall be made subject to his furnishing the Owner with release in satisfactory form of all claims against the Owner arising under and by virtue of this contract, other than such claims, if any, as may be specifically expected by the Contractor from the operation of the release as provided under general and special conditions elsewhere in this contract.
- (2) The Owner, before paying the final estimate, may require the Contractor to furnish releases or receipts from all subcontractors having performed any work and all persons having supplied materials, equipment (*installed under this contract*) and services to the Contractor, if the Owner deems the same necessary in order to protect

the Owner's interests. The Owner, however, may if it deems such action advisable make payments in part or in full to the Contractor without requiring the furnishing of such releases or receipts and any payments so made shall in no way impair the obligations of any surety or sureties furnished under this contract.

- (3) Withholding of any amount due the Owner, under general and/or special conditions regarding "Liquidated Damages", shall be deducted from the final payment due the Contractor.

## **5. REVIEW BY OWNER**

- (a) The Owner's authorized representative and agents of the Owner, shall, at all times have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material invoices, and other relevant data and records pertaining to this Contract, provided, however that all instructions and approval with respect to the work will be given to the Contractor only by the Owner through authorized representatives or agents.

## **6. FLOOD HAZARD INSURANCE**

NOT USED

## **7. OPERATION AND MAINTENANCE MANUALS AND TRAINING**

- (a) The Contractor shall obtain installation, operation, and maintenance manuals from manufacturers and suppliers for equipment furnished under the contract. The Contractor shall submit three (3) copies of each complete manual to the Engineer within ninety (90) days after approval of shop drawings, product data, and samples, and no later than the date of shipment of each item of equipment to the project site or storage location.
- (b) Each manual is to be bound in a folder and labeled to identify the contents and project to which it applies. The manual shall contain the following applicable items:
  - (1) A listing of the manufacturer's identification, including order number, model, serial number, and location of parts and service centers,
  - (2) A list of recommended stock of parts, including part number and quantity,
  - (3) Complete replacement parts list,
  - (4) Performance data and rating tables,
  - (5) Specific instructions for installation, operation, adjustment, and maintenance,
  - (6) Exploded view drawings for major equipment items,
  - (7) Lubrications requirements, and



- (8) Complete equipment wiring diagrams and control schematics with terminal identification.
- (c) The Contractor shall obtain three (3) electronic copies of the installation operation and maintenance manuals from manufacturers and suppliers for equipment furnished under the Contract.
- (d) Operations and Maintenance manuals specified herein are in addition to any operation, maintenance, or installation instructions required by the Contractor to install, test, and start up equipment.
- (e) The Owner shall require the Engineer to promptly review each manual submitted, noting necessary corrections and revisions. If the Engineer rejects the manual, the Contractor shall correct and resubmit the manual until it is acceptable to the Engineer as being in conformance with design concept of the project and for compliance with information given in the contract documents. The Owner may assess the Contractor a charge for reviews of the same items in excess of two (2) times. Such procedure shall not be considered cause for delay. Acceptance of manuals by the Engineer does not relieve the Contractor of any requirements or terms of the contract.
- (f) The Contractor shall provide the services of trained, qualified technicians to check final equipment installation, to assist as required in placing same in operation and to instruct operating personnel in the proper manner of performing routine operation and maintenance of the equipment.

## **8. AS-BUILT DIMENSION AND DRAWINGS**

- (a) The Contractor shall make appropriate daily measurements of facilities constructed and keep accurate records of location (*horizontal and vertical*) of all facilities.
- (b) Upon completion of each facility, the Contractor shall furnish the Owner with one set of direct prints, marked with red pencil, to show as-built dimensions and locations of all work constructed. As a minimum, the final drawings shall include the following:
  - (1) Horizontal and vertical locations of work,
  - (2) Changes in equipment and dimensions due to substitutions,
  - (3) "Nameplate" data on *all* installed equipment,
  - (4) Deletions, additions, and changes to scope of work, and
  - (5) Any other changes made.

**9. ARCHAEOLOGICAL DISCOVERIES**

No activity that may affect a State Archaeological Landmark is authorized until the Owner has complied with the provisions of the Antiquities Code of Texas. The Owner has previously coordinated with the appropriate agencies and impacts to known cultural or archaeological deposits have been avoided or mitigated. However, the Contractor may encounter unanticipated cultural or archaeological deposits during construction. In particular, the Contractor shall provide all professional archeological serviced as required in Section 01810 for constructing new effluent pipeline.

If archaeological sites or historic structures are discovered after construction operations are begun, the Contractor shall immediately cease operations in that particular area and notify the Owner and the Texas Historical Commission (512/463-6096). The Contractor shall take responsible steps to protect and preserve the discoveries until they have been inspected by the Owner's representative. The Contractor shall provide profession archeological services to promptly coordinate with the Texas Historical Commission and any other appropriate agencies to obtain any necessary approvals or permits to enable the work to continue. The Contractor shall not resume work in the area of the discovery until authorized to do so by the Owner.

**10. ENDANGERED SPECIES**

No activity is authorized that is likely to jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the Federal Endangered Species Act (ESA), and/or the State of Texas Parks and Wildlife Code on Endangered Species, or to destroy or adversely modify the habitat of such species.

If a threatened or endangered species is encountered during construction, the Contractor shall immediately cease work in the area of the encounter and notify the Owner, who will immediately implement actions in accordance with the ESA and applicable state statutes. These actions shall include reporting the encounter to the U.S. Fish and Wildlife Service and the Texas Parks and Wildlife Department, obtaining any necessary approvals or permits to enable the work to continue, or implement other mitigative actions. The Contractor shall not resume construction in the area until authorized to do so by the Owner.

**11. LAWS TO BE OBSERVED**

In the execution of the contract, The Contractor must comply with all applicable Local, State and Federal Laws, including but not limited to laws concerned with labor, safety, minimum wages, and the environment. The Contractor shall make himself familiar with and at all times shall observe and comply with *all* Federal, State, and Local laws, ordinances and regulations which in any manner affect the conduct of the work, and shall indemnify and save harmless the Owner and their representatives against any claim arising from violation of any such laws, ordinances or regulation by himself or by his subcontractor or his employees.

**12. EMPLOYMENT OF LOCAL LABOR**

The Contractor shall to the maximum feasible extent employ local labor for construction of the project which is, or reasonable may be done on-site work, shall employ, in carrying out such

contract work, qualified persons who regularly reside within the political subdivision boundary of the Owner and economically distressed area where the project is located, except:

- (a) To the extent that qualified persons regularly residing within the political subdivision boundary of the Owner and the economically distressed area are not available.
- (b) For the reasonable needs of any such Contractor or subcontractor to employ supervisory or specially experienced individuals necessary to assure an efficient execution of contract.
- (c) For the obligation of any such Contractor or subcontractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that in no event shall the number of non-resident persons employed under this subparagraph exceed twenty (20%) percent of the total employees employed by such Contractor and his/her subcontractor on such project.

Every such Contractor and his subcontractor shall furnish the Owner and the local Texas Employment Commission Office with a list of all positions for which it may from time to time require laborers, mechanics, and other employees, the estimated numbers of employees required in each classification, and the estimated dates on which such employees will be required.

The Contractor shall give full consideration to all qualified job applicants referred by the local employment service, but is not required to employ any job applicants referred whom the Contractor does not consider qualified to perform the classification of work required.

The payrolls maintained by the Contractor shall contain the following information: The employee's full name, address and social security number, and a notification indicating whether the employee does or does not, normally reside within the political subdivision boundary of the Owner or the economically distressed area. Copies of the payroll records shall be provided to the Owner.

The Contractor shall include the provisions of this condition in every subcontract for work which is, or reasonably may be, done as on-site work.

### **13. HAZARDOUS MATERIALS**

Materials utilized in the project shall be free of any hazardous materials, except as may be specially provided for in the specifications.

If the Contractor encounters existing material on sites owned or controlled by the Owner or in material sources that are suspected by visual observation or smell to contain hazardous materials, the Contractor shall immediately notify the Engineer and the Owner. The Owner will be responsible for the testing for and removal or disposition of hazardous materials on sites owned or controlled by the Owner. The Owner may suspend the work, wholly or in part during the testing, removal or disposition of hazardous materials on sites owned or controlled by the Owner.

### **14. DOCUMENT CONFLICT RESOLUTION**

NOT USED

**15. CONTRACT AWARD**

NOT USED

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**PREPARATION GUIDELINES FOR SECTION 00630  
CONSTRUCTION MAINTENANCE BOND**

The OWNER, if the CONTRACTOR fails to perform required maintenance, may request the Surety to perform within the requirements of the bond.

It will be completed and signed by the CONTRACTOR and returned with the agreement. In the location that reads “Date (Not earlier than Construction Contract Date)”, this date will be left blank when the bonds are submitted by the Contractor and will be filled in with the Construction Contract Date, after the Owner dates the agreement. The date the OWNER dates the agreement is the Construction Contract Date.

**EXHIBIT "B"**

**CONSTRUCTION MAINTENANCE BOND**

Any singular reference to Contractor, Surety, OWNER, or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

**CONSTRUCTION CONTRACT**

Date:

Amount (In Numbers and Words):

Description (Name and Location):

**BOND**

Date (Not earlier than Contract Date):

Amount (In Numbers and Words):

Modifications to this Bond Form:

**CONTRACTOR AS PRINCIPAL**

Company: (Corp. Seal)

**SURETY**

Company: (Corp. Seal)

Signature: \_\_\_\_\_

Name and Title:

Signature: \_\_\_\_\_

Name and Title:

**WHEREAS:**

1. The CONTRACTOR and the Surety, jointly and severally, bind themselves, their officers, directors, shareholders, partners, heirs, executors, administrators, successors, and assigns to the OWNER for the performance of the Construction Contract during the warranty and guarantee periods, which is incorporated herein by reference.

2. If the CONTRACTOR repairs any and all Defects in Work during the maintenance period, the Surety and the CONTRACTOR shall have no obligation under this Bond, except to participate in conferences as provided in Subparagraph 3.1.

3. If there is no OWNER Default, the Surety's obligation under this Bond shall arise after:

3.1. The OWNER has notified the CONTRACTOR and the Surety at its address described in Paragraph 10 below that the OWNER is considering declaring a CONTRACTOR Default and has requested and attempted to arrange a conference with the CONTRACTOR and Surety to be held not later than fifteen (15) days after receipt of such notice to discuss methods of performing the Construction Contract. If the OWNER, the CONTRACTOR, and the Surety agree, the CONTRACTOR shall be allowed a reasonable time to perform the Warranty Work, but such an agreement shall not waive the OWNER's right, if any, subsequently to declare a CONTRACTOR Default; and

3.2. The OWNER has declared a CONTRACTOR Default and formally terminated the CONTRACTOR's right to complete the Warranty Work. Such CONTRACTOR Default shall not be declared earlier than twenty (20) days after the CONTRACTOR and the Surety have received notice as provided in Subparagraph 3.1; and

4. When the OWNER has satisfied the conditions of Paragraph 3 above, the Surety shall, within thirty (30) days after notice of default, and at the Surety's expense, take one of the following actions:

4.1. Arrange for the CONTRACTOR, with consent of the OWNER, to perform and complete the Warranty Work; or

4.2. Undertake to perform and complete the Warranty Work itself, through its agents or through independent contractors; or

4.3. Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

4.3.1 After investigation, determine the amount for which it may be liable to the OWNER, and as soon as practicable after the amount is determined, tender payment therefor to the OWNER; or

4.3.2 Deny liability in whole or in part and notify the OWNER citing reasons therefor.



5. If the Surety does not proceed as provided in Paragraph 4, the Surety shall be deemed to be in default on this Bond fifteen (15) calendar days after receipt of an additional written notice from the OWNER to the Surety demanding that the Surety perform its obligations under this Bond, and the OWNER shall be entitled to enforce any remedy available to the OWNER. If the Surety proceeds as provided in Subparagraph 4.3, and the OWNER refuses the payment tendered, or the Surety has denied liability, in whole or in part, without further notice, the OWNER shall be entitled to enforce any remedy available to the OWNER.
6. After the OWNER has terminated the CONTRACTOR's right to complete the Warranty Work, and if the Surety elects to act under Subparagraph 4.1 or 4.2 above, then the responsibilities of the Surety to the OWNER shall not be greater than those of the CONTRACTOR under the Construction Contract, and the responsibilities of the OWNER to the Surety shall not be greater than those of the OWNER under the Construction Contract. To the limit of the amount of this Bond, the Surety is obligated without duplication for:
- 6.1. The responsibilities of the CONTRACTOR for correction of defective work;
- 6.2. Additional legal, design professional, and delay costs resulting from the CONTRACTOR's Default, and resulting from the actions or failure to act of the Surety under Paragraph 4 above; and
7. The Surety shall not be liable to the OWNER or others for obligations of the CONTRACTOR that are unrelated to the Construction Contract. No right of action shall accrue on this Bond to any person or entity other than the OWNER or its heirs, executors, administrators, or successors.
8. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontractors, purchase orders and other obligations.
9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within one year after CONTRACTOR Default, or within one year after the CONTRACTOR ceased working, or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law; the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
10. Notice to the Surety, the OWNER, or the CONTRACTOR shall be mailed or delivered to the address shown on the signature page.
11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom, and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common-law bond.

12. Definitions.

12.1. Construction Contract: The agreement between the OWNER and the CONTRACTOR identified on the signature page, including all Contract Documents and changes thereto.

12.2. CONTRACTOR Default: Failure of the CONTRACTOR, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Construction Contract.

12.3. OWNER Default: Failure of the OWNER, which has neither been remedied nor waived, to pay the CONTRACTOR as required by the Construction Contract, or to perform and complete or comply with the other terms thereof.

END OF SECTION

2517-247787

City of Laredo - South Laredo Wastewater Treatment Plant  
Blower Building Enclosure Project

Division D

**CONSTRUCTION MAINTENANCE BOND**

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**SECTION 00840**

**CONTRACTOR AFFIDAVIT FOR PARTIAL PAYMENT**

STATE OF TEXAS §

COUNTY OF \_\_\_\_\_ §

BEFORE ME, the undersigned authority, on this day personally appeared \_\_\_\_\_  
\_\_\_\_\_ the \_\_\_\_\_  
of \_\_\_\_\_ ("Contractor"). Contractor has performed labor and furnished  
materials pursuant to that certain Contract entered into on the \_\_\_\_\_ day of \_\_\_\_\_  
\_\_\_\_\_, \_\_\_\_\_ by and between Contractor and \_\_\_\_\_ for the  
erection, construction, and completion of certain improvements and/or additions upon the  
following described premises, to wit:

The undersigned, being by me duly sworn, states upon oath that the materials supplied in  
connection with Contractor's Application for Partial Payment No.\_\_\_\_, dated \_\_\_\_\_(the  
"Application Date"), represents the actual cost of sound materials that have been or will be fabricated into  
the work in compliance with the agreed to plans and specifications (and all authorized changes thereto).

The undersigned further states that as of the Application Date Contractor has paid all bills and  
claims for materials supplied in connection with the aforesaid Partial Payment.

This affidavit is being made by the undersigned realizing that it is in reliance upon the  
truthfulness of the statements contained herein that a partial payment under said Contract is being made,  
and in consideration of the disbursement of said partial payment  
by \_\_\_\_\_ Contractor hereby agrees to indemnify  
and hold Owner safe and harmless from and against all losses, damages, costs, and expenses of any  
character whatsoever specifically including court costs, bonding fees., and attorney fees arising out of or  
in any way relating to claims for unpaid labor or materials furnished as of the Application Date.

Executed this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

Name Printed: \_\_\_\_\_

Title: \_\_\_\_\_

STATE OF TEXAS                   §  
COUNTY OF \_\_\_\_\_§

Subscribed and sworn to before me, the undersigned authority, on this the  
\_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_ to certify which, witness my hand  
and seal of office.

\_\_\_\_\_  
Notary Public, State of Texas  
Notary's Name Printed:

\_\_\_\_\_

My commission expires: \_\_\_\_\_

END OF SECTION

**SECTION 00850**

**CERTIFICATION OF COMPLETION**  
**(By Contractor)**

We hereby certify that the work on Project "South Laredo Wastewater Treatment Plant Blower Building Enclosure Project" has been completed in substantial compliance with the PLANS and TECHNICAL SPECIFICATIONS.

\_\_\_\_\_  
CONTRACTOR'S Company Name

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

Title: \_\_\_\_\_

Date: \_\_\_\_\_

END OF SECTION

2517-247787

City of Laredo - South Laredo Wastewater Treatment Plant  
Blower Building Enclosure Project

**Division D**  
**CERTIFICATION OF COMPLETION**  
**(BY CONTRACTOR)**

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**SECTION 00855**

**CERTIFICATION OF COMPLETION**  
**(By Subcontractor)**

We hereby certify that

the \_\_\_\_\_

\_\_\_\_\_

(Description of Work Performed)

\_\_\_\_\_

work performed by us on Project "South Laredo Wastewater Treatment Plant Blower Building Enclosure Project" has been completed in substantial compliance with the PLANS and TECHNICAL SPECIFICATIONS.

\_\_\_\_\_  
SUBCONTRACTOR'S Company Name

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

Title: \_\_\_\_\_

Date: \_\_\_\_\_

END OF SECTION



2517-247787

City of Laredo - South Laredo Wastewater Treatment Plant  
Blower Building Enclosure Project

**Division D**  
**CERTIFICATION OF COMPLETION**  
**(BY SUBCONTRACTOR)**

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## SECTION 01010 - SUMMARY

### 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. Project information.
2. Work covered by Contract Documents.
3. Sequencing of Work
4. Contractor's use of site and premises.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and Drawing conventions.
8. Miscellaneous provisions.

- B. Related Requirements:

1. Section 01500 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 01730 "Execution" for coordination of Owner-installed products.

#### 1.3 DEFINITIONS

- A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

#### 1.4 PROJECT INFORMATION

- A. Project Identification: South Laredo Wastewater Treatment Plant Blower Building Enclosure, CDM Smith Project No: 247787

1. Project Location: 309 River Front St., Laredo, Texas 78046

- B. Owner:

1. Owner's Representative: City of Laredo

- C. Engineer: CDM Smith  
Christopher Varnon, P.E.

11490 Westheimer Rd, Suite 700  
Houston, TX 77077  
Phone: 713-423-7313

## 1.5 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
  - 1. Modifications to the South Laredo WWTP Blower Building to enclose the blower rooms, provide HVAC improvements, modify the blower process air intakes, cooling air intakes, and cabinet cooling exhaust, and other Work indicated in the Contract Documents. Coordination with the blower manufacturer (Sulzer) shall include the following items:
    - a. Blower manufacturer to supply inlet transition piece, wire mesh screen (“scrap trap”), single arch rubber bellow style flexible connection, and intake silencer, with installation instructions, for installation by Contractor after removal of inlet filter housing (ITFL).
    - b. Blower manufacturer to provide field services for up to three (3) site visits, three (3) 8-hour days each, for installation inspection, start-up assistance, and commissioning services.
- B. Type of Contract:
  - 1. Project will be constructed under a single prime contract.

## 1.6 SEQUENCING OF WORK

- A. Contractor shall sequence work to adhere to the following constraints.
  - 1. A minimum of two magnetic bearing blowers and the positive displacement blower OR four magnetic bearing blowers shall remain in service at all times.

## 1.7 CONTRACTOR’S USE OF SITE AND PREMISES

- A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- C. Limits on Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

- a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
- b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

E. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

## 1.8 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy Project site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 48 hours in advance of activities that will affect Owner's operations.

## 1.9 WORK RESTRICTIONS

A. On-Site Work Hours: Limit work to between 8 a.m. to 5 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:

1. Notify Engineer not less than 7 days in advance of proposed utility interruptions.
2. Obtain Engineer's written permission before proceeding with utility interruptions.
3. Maintain list of approved screened personnel with Owner's representative.

## 1.10 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
  3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
  4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
  3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01110

SECTION 01011  
SITE CONDITIONS

PART 1: GENERAL

1.01 SITE CONDITIONS GENERAL

- A. Contractor's work will be performed within an existing structure on site. Contractor is responsible for protecting existing utilities, structures, and equipment when performing work.

1.02 MEASUREMENT AND PAYMENT

- A. No separate payment will be made for this Work. Include payment in the lump sum base bid.

1.03 SITE INVESTIGATION AND REPRESENTATION

- A. The Contractor acknowledges that he has satisfied himself as to the nature and location of the work; the general and local conditions, particularly those bearing upon availability of transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads, and uncertainties of weather, river/stream stages, or similar physical conditions at the site; the conformation and conditions of the ground; the character of equipment and facilities needed preliminary to and during the prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this Contract.
- B. The Contractor further acknowledges that he has satisfied himself as to the character, quality, and quantity of surface and subsurface materials to be encountered from inspecting the site, as well as from information presented herein as a part of these Contract Documents. Any failure by the Contractor to acquaint himself with all the available information will not relieve him from responsibility for properly estimating the difficulty or cost of successfully performing the work. Neither the Owner nor the Engineer assumes responsibility for any conclusion or interpretation made by the Contractor on the basis of the information made available by the Owner or the Engineer.

1.04 RESPONSIBILITY FOR UTILITY PROPERTIES AND SERVICE

- A. Known utilities and structures adjacent to or encountered in the work are shown on the Drawings. The locations shown are taken from existing records and the best information available from existing plans; however, it is expected that there may be some discrepancies and omissions in the locations and quantities of utilities and structures shown. Contractor shall notify the Owner or the Engineer for such discrepancies should they be identified in the field. Those shown are for the convenience of the Contractor only, and no responsibility is assumed by either the Owner or the Engineer for their accuracy or completeness.
- B. Neither the Owner nor his officers or agents shall be responsible to the Contractor for damages as a result of the Contractor's failure to protect utilities encountered in the work.
- C. The Contractor shall at all times provide unobstructed access to fire hydrants, underground conduit, manholes, and water or gas valve boxes.
- D. Where the Contractor's operations could cause damage which might result in considerable expense, loss, and inconvenience when his operations are adjacent to or near railway, telegraph, telephone, television, power, oil, gas, water, sewer, irrigation, or other systems, no operations shall be

commenced until the Contractor has made all arrangements necessary for the protection of these utilities and services.

- E. The Contractor shall notify all utility offices that are affected by the construction operation at least 15 days in advance of commencing construction operations. The Contractor shall not expose any utility without first obtaining permission from the affected agency. Once permission has been granted, locate and, if necessary, expose and provide temporary support for all existing underground utilities in advance of operations.
- F. The Contractor shall be solely and directly responsible to the owners and operators of such utility properties for any damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of any injuries or damage that may result from the construction operations under this Contract.
- G. In the event of interruption to domestic water, sewer, storm drain, or other utility services as a result of accidental breakage due to construction operations, the Contractor shall promptly notify the proper authority and cooperate with said authority in restoration of service as promptly as possible and bear all costs of repair. In no event shall interruption of any water or utility service be allowed unless prior approval is granted by the owner of the utility.
- H. The Contractor shall replace, at his own expense, any and all other existing utilities or structures removed or damaged during construction, unless otherwise provided for in these Contract Documents.
- I. Where existing utility lines or structures are so located as to physically conflict with permanent structures to be constructed under this Contract, the conflicting utility line or structure shall be permanently relocated. Such relocations shall be considered as required by this Contract.
- J. The Contractor shall give immediate notice to the Engineer, the Owner and the owner of the utility (where applicable) when a physical conflict is determined to exist. Any delays resulting from the required relocations of the utilities are the responsibility of the Contractor.
- K. Where existing utility lines or structures are so located as to interfere with the Contractor's prosecution of the work, but do not physically conflict with completed manholes or other permanent structures to be constructed under this Contract, any modification, alteration, or relocation of interfering utility, either permanent or temporary, shall be accomplished at the expense of the Contractor.
- L. The Contractor shall give immediate notice to the Engineer and the owner of the utility when interference is determined to exist and shall obtain approval to relocate such utility or to discontinue service therein from the Engineer and the owner of the utility. The owner of the utility shall have the right to do all work required to discontinue, relocate, and replace interfering utilities and charge the Contractor for all costs thereof. When approved by the Engineer and the owner of the utility, all work required to discontinue, relocate, and replace interfering utilities may be done by, or arranged for, by the Contractor. All such discontinuance, relocation, and replacement shall be accomplished in accordance with all requirements of the owner of the utility.
- M. When notified by the Contractor that an interference or conflict has been determined to exist, the Engineer will determine whether such interference shall be considered as required by construction or as incidental to construction.
- N. Prior to construction Contractor shall take pictures of existing site and plant roads to document pre-construction conditions and submit it to the City of Laredo Utilities Department as a submittal. The Contractor shall maintain the existing site and roads in a condition at least equal to what existed

before the construction. Contractor shall be responsible for any repairs required to the existing plant roads due to the Contractor's negligence during the construction.

#### 1.05 INTERFERING STRUCTURES

- A. Take necessary precautions to prevent damage to existing structures whether on the surface, aboveground, or underground. An attempt has been made to show major structures on the Plans. While the information has been compiled from the best available sources, its completeness and accuracy cannot be guaranteed, and it is presented as a guide to avoid known possible difficulties.
- B. Protect existing structures from damage, whether or not they lie within the right-of-way, or the limits of the easements obtained by the Owner. Where existing structures must be removed to properly conduct the work, or are damaged during the work, they shall be restored at the Contractor's own expense to at least their original condition and to the satisfaction of the Engineer.
- C. The Contractor may, with the approval of the Engineer and without additional compensation, remove and replace in a condition as good as or better than original, any small interfering structures such as fences and signposts that interfere with the Contractor's operations.

#### 1.06 FIELD RELOCATION

- A. During the progress of the work, minor relocations of the work may be necessary. Such relocations shall be made only by direction of the Engineer. If existing structures are encountered that will prevent construction as shown, notify the Engineer before continuing with the work in order that the Engineer may make such field revisions as necessary to avoid conflict with the existing structures. If the Contractor fails to notify the Engineer when an existing structure is encountered and proceeds with the work despite this interference, he shall be responsible for any damage that may occur.

#### 1.07 LAND MONUMENTS

- A. The Contractor shall preserve or replace any existing Federal, State, County, City, and private land monuments encountered. All monument replacement by the Contractor shall be performed by a land surveyor licensed in the State of Texas.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION



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SECTION 01110  
ENVIRONMENTAL PROTECTION PROCEDURES

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. The work covered by this Section consists of furnishing all labor, materials and equipment and performing all work required for the prevention of environmental pollution in conformance with applicable laws and regulations, during and as the result of construction operations under this Contract. For the purpose of this Specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and/or recreational purposes.
- B. The control of environmental pollution requires consideration of air, water and land, and involves management of noise and solid waste, as well as other pollutants.
- C. Schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the work. Provide erosion control measures such as sedimentation or filtration systems, berms, silt fences, seeding, mulching or other special surface treatments as are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion control measures shall be in place in an area prior to any construction activity in that area. Specific requirements for erosion and sedimentation controls are specified in Section 02270.
- D. This Specification is intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.
- E. All phases of sedimentation and erosion control shall comply with and be subject to the approval of the Texas Commission on Environmental Quality and the U.S. Environmental Protection Agency.

1.02 MEASUREMENT AND PAYMENT

- A. No separate payment will be made for this Work. Include payment in the lump sum base bid.

1.03 APPLICABLE REGULATIONS

- A. Comply with all applicable Federal, State and local laws and regulations concerning environmental pollution control and abatement.

1.04 NOTIFICATIONS

- A. The Engineer will notify the Contractor in writing of any non-compliance with the foregoing provisions or of any environmentally objectionable acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the Contractor in writing, through the Engineer, of any non-compliance with State or local requirements. The Contractor shall, after receipt of such notice from the Engineer or from the regulatory agency through the Engineer, immediately take corrective action. Such notice,

when delivered to the Contractor or his/her authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance.

#### 1.05 IMPLEMENTATION

- A. Prior to commencement of the work, meet with the Owner to develop mutual understandings relative to compliance with this provision and administration of the environmental pollution control program.
- B. Remove temporary environmental control features, when approved by the Engineer, and incorporate permanent control features into the project at the earliest practicable time.

#### 1.06 PROTECTION OF WATERWAYS

- A. The Contractor shall observe the rules and regulations of the State of Texas and agencies of the U.S. Government prohibiting the pollution of any lake, stream, river, or wetland by the dumping of any refuse, rubbish, dredge material, or debris therein.
- B. Contractors are specifically cautioned that disposal of materials into any waters of the State must conform with the requirements of the Texas Commission on Environmental Quality, and an applicable permit from the U.S. Army Corps of Engineers.

#### 1.07 DISPOSAL OF EXCESS EXCAVATION AND OTHER WASTE MATERIALS

- A. The Contractor shall provide watertight conveyance of any liquid, semi-liquid, or saturated solids which tend to bleed or leak during transport. No liquid loss from transported materials will be permitted whether being delivered to the construction site or being hauled away for disposal. Fluid materials hauled for disposal must be specifically acceptable at the selected disposal site.

#### 1.08 USE OF CHEMICALS

- A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture or any other applicable regulatory agency. Use of all such chemicals and disposal of residues shall be in conformance with the manufacturer's instructions.
- B. Any oil or other hydrocarbon spilled or dumped on the Owner's site during construction must be excavated and completely removed from the site prior to final acceptance. Soil contaminated by the Contractor's operations shall become the property of the Contractor, who will bear all costs of testing and disposal.
- C. Before a Contractor commences work, the following steps shall be completed.
  - 1. The Owner will inform Contractor of his rights under the Texas Hazards Communication Act.
  - 2. The Owner will provide a copy of the Chemical List giving the hazardous chemicals to which the Contractor, his employees and agents may be exposed to on the project site.

3. The Owner will provide copies of all MSDSs to the Contractor for the hazardous chemicals which he may be exposed to on the project site.
4. The Owner will inform the Contractor of his obligation to inform his employees and agents of each of the above requirements.
5. The Contractor shall provide MSDSs for all hazardous chemicals he may bring onto the project site that Owner's employees may be exposed to.
6. The Contractor shall sign a Contractor Acknowledgement certifying that he has received the information provided by the Owner on hazardous chemicals and maintain the Acknowledgement with the original Contract.

## PART 2: PRODUCTS - NOT USED

## PART 3: EXECUTION

### 3.01 EROSION CONTROL

### 3.02 PROTECTION OF STREAMS

- A. Care shall be taken to prevent, or reduce to a minimum, any damage to any stream from pollution by debris, sediment, or other material, or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the stream, shall not be directly returned to the stream. Such waters will be diverted through a settling basin or filter before being directed into the streams.
- B. The Contractor shall not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water or any storm sewer. Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water.
- C. All preventative measures shall be taken to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action plan approved by the Texas Commission on Environmental Quality. Contractor shall submit two copies of approved contingency plans to the Engineer.

### 3.03 PROTECTION OF AIR QUALITY

- A. Air pollution shall be minimized by wetting down bare soils during windy periods, or as requested by OWNER, by requiring the use of properly operating combustion emission control devices on construction vehicles and equipment used by Contractor and by encouraging the shutdown of motorized equipment not actually in use.
- B. Burning. The use of burning at the project site for the disposal of refuse and debris will not be permitted.

3.04 MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION

- A. During the life of this Contract, maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

3.05 NOISE CONTROL

- A. The Contractor shall make every effort to minimize noises caused by his/her operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with State and Federal regulations.

END OF SECTION

SECTION 01170  
SPECIAL PROVISIONS

PART 1: GENERAL

1.01 GENERAL OBLIGATIONS OF THE CONTRACTOR

- A. General obligations of the Contractor shall be as set forth in the Contract Documents. Unless special payment is specifically provided in the payment paragraphs of the specifications, all incidental work and expense in connection with the completion of work under the contract will be considered a subsidiary obligation of the Contractor, and all such costs shall be included in the appropriate items in the Bid Form in connection with which the costs are incurred.

1.02 MEASUREMENT AND PAYMENT

- A. No separate payment will be made for this Work. Include payment in the lump sum base bid.

1.03 SITE INVESTIGATION

- A. The Contractor shall satisfy himself as to the conditions existing within the project area, the type of equipment required to perform the work, the character, quality and quantity of the subsurface materials to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, as well as from information presented by the Drawings and Specifications. Any failure of the Contractor to acquaint himself with the available information will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work. The Owner assumes no responsibility for any conclusions or interpretation made by the Contractor on the basis of the information made available by the Owner.

1.04 COORDINATION WITH CITY AGENCIES

- A. The Contractor shall supply the Laredo Police Department, Fire Department, and the Public Works Department with the following information:
  - 1. A list of streets and intersections where work will be in progress to be supplied at intervals as required by the Engineer.
  - 2. Areas where approved detours are in effect.
  - 3. Immediate notification of any gas or water main breaks.
- B. The Contractor will be required to reimburse the City for the actual cost of the services of Public Works Department Personnel required by the Contractor during other than regular working hours.

1.06 GREASE, OIL AND FUEL

- A. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied under Divisions 11, 13, and 15.

#### 1.07 TOOLS

- A. Any special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, and maintenance of any equipment shall be furnished with the respective equipment.
- B. Tools shall be furnished in suitable large tool boxes.

#### 1.08 POWER SUPPLY

- A. Unless otherwise specified, all motors 1/2 horsepower and larger shall be designed for a power supply of 480 volts, 3 phase, 60 Hertz, and all motors 1/3 horsepower and smaller shall be designed for a power supply of 120 volts, single phase, 60 Hertz.

#### 1.09 MOTORS

- A. All motors shall have Class F or H insulation, as required by Section 01171, with a Class B temperature rise and a service factor not less than 1.15.

#### 1.10 MAINTAINING EXISTING ELECTRICAL SERVICE

- A. During construction, the Contractor shall make all arrangements with the electric utility for pole line extensions, pole relocations, etc., for the temporary electrical service and include all costs for the temporary service in his bid.

#### 1.11 MAINTENANCE AND LUBRICATION SCHEDULES

- A. Each Contractor's attention is directed to Section 01300 for all requirements relative to the submission of shop and working drawings for the mechanical and electrical and instrumentation equipment. For all mechanical and electrical equipment furnished, each Contractor shall provide a list including the equipment name, and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained. In addition, a maintenance and lubrication schedule for each piece of equipment shall be submitted along with shop drawings. Submission shall be in seven copies.

#### 1.12 SHIPMENT AND DELIVERY OF EQUIPMENT

- A. Equipment shall not be shipped until approved by the Engineer. The intent of this requirement is to reduce site storage time prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to anticipated installation without written authorization from the Engineer.
- B. During shipment and delivery, the following procedures shall apply:
  - 1. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay between time of shipment and installation, including any prolonged period at the site.
  - 2. Factory assembled parts and components shall not be disassembled for shipment unless permission is received in writing from the Engineer.

3. Finished surfaces of all exposed parts shall be properly protected against adverse conditions that may prevail from time of shipment until ready for operation.
4. All finished surfaces of all exposed flanges shall be protected by wooden blank flanges, stoutly built, and securely bolted.
5. Finished iron and steel surfaces not painted shall be protected against rust and corrosion.
6. After hydrostatic or other tests, all entrapped water shall be drained, and care taken to prevent the entrance of water during shipment, storage, and handling.
7. Each box or package shall be legibly marked to show its net weight and contents.
8. At the time of shipment, the shipping list, original bill of lading, shipping memorandum, and invoice shall be mailed in triplicate to the Engineer. Each shipping list shall give the description and net weight of each item, and gross weight of the shipment. Shipment will not be accepted until the list has been received.
9. Demurrage, or other charges resulting from failure to furnish these items shall be absorbed by the Contractor.
10. The Contractor shall make suitable provision for the handling and delivery of all equipment and material at the site.

#### 1.13 STORAGE AND HANDLING OF EQUIPMENT ON SITE

- A. Special attention shall be given to the storage and handling of equipment on site. As a minimum, the procedure outlined below shall be followed:
  1. All equipment having moving parts such as gears, electric motors, etc., and/or instruments shall be stored in a temperature and humidity controlled building approved by the Engineer, until such time as the equipment is to be installed.
  2. All equipment shall be stored fully lubricated with oil, grease, etc., unless otherwise instructed by the manufacturer.
  3. Manufacturer's storage instructions shall be carefully studied by the Contractor and reviewed with the Engineer by him. These instructions shall be carefully followed and a written record of this kept by the Contractor.
  4. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.
  5. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment at the time of acceptance.
  6. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment to certify that its condition has not been detrimentally affected by the long storage period. Such certification by the manufacturer shall be deemed to mean that the equipment is



judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

#### 1.14 SPECIAL PRECAUTIONS

- A. The Contractor shall conduct his operations in a manner to safe-guard against hazards from gasses and other items up until the time the work is complete. Safe-guards shall include ventilation system equipment, gas detection equipment, respiratory equipment, and other equipment as appropriate for the application.

#### 1.16 INSTALLATION OF EQUIPMENT

- A. Special care shall be taken to ensure proper alignment of all equipment with particular reference to the pumps and electric drives. The units shall be carefully aligned on their foundations by qualified millwrights after their sole plates have been shimmed to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the foundation alignments have been approved by the Engineer, the bedplates or wing feet of the equipment shall be securely bolted in place. The alignment of equipment shall be further checked after securing to the foundations, and after confirmation of all alignments, the sole plates shall be finally grouted in place. The Contractor shall be responsible for the exact alignment of equipment with associated piping and under no circumstances, will "pipe springing" be allowed.
- B. All wedges, shims, filling pieces, keys, packing, grout, or other materials necessary to properly align, level and secure apparatus in place shall be furnished by the Contractor. All parts intended to be plumb or level must be proven exactly so. Perform all grinding necessary to bring parts to proper bearing after erection.
- C. Handle, store and install equipment in accordance with the manufacturer's Drawings and recommendations. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contractor Document.

#### 1.17 SLEEVES AND OPENINGS

- A. The Contractor shall do all cutting, coring and rough and finish patching required in existing construction for the work of all trades.
- B. Subcontractors shall furnish all sleeves, inserts, hangers, anchor bolts, etc, required for the execution of their work. It shall be their responsibility before the work of the Contractor is begun to furnish him/her with the above items and with templates, drawings or written information covering chases, openings, etc, which they require and to follow up the work of the Contractor as it progresses, making sure that their drawings and written instructions are followed. Failing to do this, they shall be responsible for the cost of any corrective measures which may be required to provide necessary openings, etc. If the Contractor fails to follow the directions given him/her, covering details and locations of openings, etc, he/she shall be responsible for any cutting and refinishing required to make the necessary corrections. In no case shall beams, lintels, or other structural members be cut without the approval of the Engineer.

#### 1.20 NOISE LIMITATIONS

- A. All equipment to be furnished under this Contract, unless specified otherwise in the technical specifications, shall be designed to ensure that the sound pressure level does not exceed 85 decibels over a frequency range of 37.8 to 9600 cycles per second at a distance of three feet from any portion of the equipment, under any load condition, when tested using standard equipment and methods. Noise levels shall include the noise from the motor. Mufflers or external baffles shall not be acceptable for the purpose of reducing noise. Data on noise levels shall be included with the shop drawing submittal.

1.23 REUSE AND REPLACEMENT OF EXISTING MATERIALS AND EQUIPMENT

- A. Except specifically indicated or specified, materials and equipment removed from any existing structure shall not be used in the completed Work.
- B. For the pieces of equipment to be reused in the work:
  - 1. Use special care in removal, handling, storage and reinstallation, to assure proper function in the completed Work.
  - 2. Arrange for transportation, storage and handling of products, which require off-site storage, restoration or renovation. Pay all costs for such work.

PART 2: PRODUCTS - NOT USED

PART 3: EXECUTION - NOT USED

END OF SECTION

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## SECTION 01250 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Section 01600 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

#### 1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

#### 1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use form approved by Engineer.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication, or installation method cannot be provided, if applicable.
    - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

- c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
  - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of Engineers and owners.
  - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

## 1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

## 1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

## 1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

- 1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
- b. Substitution request is fully documented and properly submitted.
- c. Requested substitution will not adversely affect Contractor's construction schedule.
- d. Requested substitution has received necessary approvals of authorities having jurisdiction.
- e. Requested substitution is compatible with other portions of the Work.
- f. Requested substitution has been coordinated with other portions of the Work.
- g. Requested substitution provides specified warranty.

- B. Substitutions for Convenience: Engineer will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Engineer.

- 1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
- b. Requested substitution does not require extensive revisions to the Contract Documents.
- c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
- d. Substitution request is fully documented and properly submitted.
- e. Requested substitution will not adversely affect Contractor's construction schedule.
- f. Requested substitution has received necessary approvals of authorities having jurisdiction.
- g. Requested substitution is compatible with other portions of the Work.
- h. Requested substitution has been coordinated with other portions of the Work.

- i. Requested substitution provides specified warranty.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01250

## SECTION 01260 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
  - 1. Section 01250 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
  - 2. Section 01310 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

#### 1.3 MINOR CHANGES IN THE WORK

- A. Engineer will issue Field Orders authorizing minor changes in the Work, not involving adjustment to the Contract Price or the Contract Time, on EJCDC Form C-942.

#### 1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Price or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Requests For Proposal (RFP) issued by Engineer are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of RFP, submit a quotation estimating adjustments to the Contract Price and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and



finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- e. Quotation Form: Use forms acceptable to Engineer.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Engineer.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Price and the Contract Time.
  2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  4. Include costs of labor and supervision directly attributable to the change.
  5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  6. Comply with requirements in Section 01250 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
  7. Proposal Request Form: Use form acceptable to Engineer.

## 1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 01210 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Price to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 01220 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

## 1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Change Order Request, Engineer will issue a Change Order for signatures of Owner and Contractor on EJCDC Form C-941.

## 1.7 WORK CHANGE DIRECTIVE

- A. Work Change Directive: Engineer may issue a Work Change Directive on EJCDC Document C-940. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Price or the Contract Time.

- B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01260

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## SECTION 01290 - PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Section 01260 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 2. Section 01320 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

#### 1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

#### 1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
  - 2. Submit the schedule of values to Engineer at earliest possible date, but no later than ten days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
  - 1. Identification: Include the following Project identification on the schedule of values:
    - a. Project name and location.
    - b. Name of Engineer.
    - c. Engineer's Project number.
    - d. Contractor's name and address.

- e. Date of submittal.
2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
    - a. Related Specification Section or division.
    - b. Description of the Work.
    - c. Name of subcontractor.
    - d. Name of manufacturer or fabricator.
    - e. Name of supplier.
    - f. Change Orders (numbers) that affect value.
    - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
      - 1) Labor.
      - 2) Materials.
      - 3) Equipment.
  3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
  4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
  5. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
  6. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct coat of actual work-in-place as separate line items.
  7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
  8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

## 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.
- B. Payment Application Times: Submit Application for Payment to Engineer by the tenth of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
  1. Date of submittal may be altered upon discussion with Engineer and Owner for appropriate timing for processing of applications for payment.

- C. Application for Payment Forms: Use EJCDC Document C-620 as form for Applications for Payment.
1. Other Application for Payment forms proposed by the Contractor may be acceptable to Engineer and Owner. Submit forms for approval with initial submittal of schedule of values.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.
1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
  4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment.
  2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
  3. Provide summary documentation for stored materials indicating the following:
    - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.

2. When an application shows completion of an item, submit conditional final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Maintain an updated set of drawings to be used as record drawings in accordance with Section 01783 "Project Record Documents." As a prerequisite for monthly progress payments, exhibit the updated record drawings for review by Owner and Engineer for completeness and accuracy.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of values.
  3. Contractor's construction schedule.
  4. Products list (preliminary if not final).
  5. Schedule of unit prices.
  6. Submittal schedule.
  7. List of Contractor's staff assignments.
  8. List of Contractor's principal consultants, if used.
  9. Copies of building permits.
  10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  11. Initial progress report.
  12. Report of preconstruction conference.
- J. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. Include initial submittal of closeout record drawings in accordance with Section 01783 "Project Record Documents."
- K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Final submittal of closeout record drawings in accordance with Section 01783 "Project Record Documents."
  4. Updated final statement, accounting for final changes to the Contract Sum.
  5. Evidence that claims have been settled.

6. Final liquidated damages settlement statement, if applicable.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01290



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## SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. RFIs.
  - 4. Digital project management procedures.
  - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
  - 1. Section 01320 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 2. Section 01730 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Section 01770 "Closeout Procedures" for coordinating closeout of the Contract.

#### 1.3 DEFINITIONS

- A. RFI: Request for Information. Request from Owner, Engineer, or Contractor seeking information required by or clarifications of the Contract Documents.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.

- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities, list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
  - 1. Post copies of list in prominent location in work area. Keep list current at all times.

## 1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of Contractor's construction schedule.
  - 2. Preparation of the schedule of values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.
  - 6. Preinstallation conferences.
  - 7. Project closeout activities.
  - 8. Startup and adjustment of systems.

## 1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

- a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
- b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
- c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
- d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
- e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
- f. Indicate required installation sequences.
- g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
  - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
  - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
  - c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
  - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
  - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.

- c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
  - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following:
- a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Engineer will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Engineer will so inform Contractor, who shall make suitable modifications and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01330 "Submittal Procedures."

#### 1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Engineer will return without response those RFIs submitted to Engineer by other entities controlled by Contractor.
  2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
  2. Project number.
  3. Name of Engineer.
  4. Date.
  5. Name of Contractor.
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Specification Section number and title and related paragraphs, as appropriate.
  9. Drawing number and detail references, as appropriate.
  10. Field dimensions and conditions, as appropriate.
  11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  12. Contractor's signature.
  13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

- a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Engineer.
1. Attachments shall be electronic files in PDF format.
- D. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow seven days for Engineer's response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Engineer's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt by Engineer of additional information.
  3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01260 "Contract Change Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly. Include the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Engineer.
  4. RFI number including RFIs that were returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Engineer's response was received.
  8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

- F. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within seven days if Contractor disagrees with response.

## 1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Engineer's Digital Data Files: Digital data files of Engineer's CAD drawings will be provided by Engineer for Contractor's use during construction.
  - 1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
  - 2. Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
  - 3. Digital Drawing Software Program: Contract Drawings are available in AutoCAD.
  - 4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement or other Agreement form acceptable to Owner and Engineer.
    - a. Subcontractors, and other parties granted access by Contractor to Engineer's digital data files shall execute a data licensing agreement.
- B. Web-Based Project Software: Use Engineer's web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.
- C. PDF Document Preparation: Where PDFs are required to be submitted to Engineer, prepare as follows:
  - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  - 2. Name file with submittal number or other unique identifier, including revision identifier.
  - 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

## 1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
  - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within three days of the meeting.

- B. Preconstruction Conference: Engineer will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than 15 days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Responsibilities and personnel assignments.
    - b. Tentative construction schedule.
    - c. Phasing.
    - d. Critical work sequencing and long lead items.
    - e. Designation of key personnel and their duties.
    - f. Lines of communications.
    - g. Use of web-based Project software.
    - h. Procedures for processing field decisions and Change Orders.
    - i. Procedures for RFIs.
    - j. Procedures for testing and inspecting.
    - k. Procedures for processing Applications for Payment.
    - l. Distribution of the Contract Documents.
    - m. Submittal procedures.
    - n. Sustainable design requirements.
    - o. Preparation of Record Documents.
    - p. Use of the premises and existing building.
    - q. Work restrictions.
    - r. Working hours.
    - s. Owner's occupancy requirements.
    - t. Responsibility for temporary facilities and controls.
    - u. Procedures for moisture and mold control.
    - v. Procedures for disruptions and shutdowns.
    - w. Construction waste management and recycling.
    - x. Parking availability.
    - y. Office, work, and storage areas.
    - z. Equipment deliveries and priorities.
    - aa. First aid.
    - bb. Security.
    - cc. Progress cleaning.
    - dd. List of major subcontractors and suppliers.
  3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Engineer, but no later than 30 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.



2. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    - a. Preparation of Record Documents.
    - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    - c. Procedures for completing and archiving web-based Project software site data files.
    - d. Submittal of written warranties.
    - e. Requirements for completing sustainable design documentation.
    - f. Requirements for preparing operations and maintenance data.
    - g. Requirements for delivery of material samples, attic stock, and spare parts.
    - h. Requirements for demonstration and training.
    - i. Preparation of Contractor's punch list.
    - j. Procedures for processing Applications for Payment at Substantial Completion and for final payment including final change order.
    - k. Submittal procedures.
    - l. Coordination of separate contracts.
    - m. Owner's partial occupancy requirements including certificate of occupancy and closeout of permits.
    - n. Installation of Owner's furniture, fixtures, and equipment.
    - o. Responsibility for removing temporary facilities and controls.
    - p. Final cleaning.
  4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- D. Progress Meetings: Conduct progress meetings at monthly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
  2. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.

- b. Review present and future needs of each entity present, including the following:
  - 1) Interface requirements.
  - 2) Sequence of operations.
  - 3) Resolution of BIM component conflicts.
  - 4) Status of submittals.
  - 5) Status of sustainable design documentation.
  - 6) Deliveries.
  - 7) Off-site fabrication.
  - 8) Access.
  - 9) Site use.
  - 10) Temporary facilities and controls.
  - 11) Progress cleaning.
  - 12) Quality and work standards.
  - 13) Status of correction of deficient items.
  - 14) Field observations.
  - 15) Status of RFIs.
  - 16) Status of Proposal Requests.
  - 17) Pending changes.
  - 18) Status of Change Orders.
  - 19) Pending claims and disputes.
  - 20) Documentation of information for payment requests.
- 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
  - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01310

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## SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work as well as scheduling constraints and requirements for construction sequencing.
- B. Related Requirements:
  - 1. Section 01310 “Project Management and Coordination”.

#### 1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
1. PDF file.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- C. Construction Schedule Updating Reports: Submit with Applications for Payment.
- D. Qualification Data: For scheduling consultant.

#### 1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Engineer's request.

#### 1.6 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
1. Secure time commitments for performing critical elements of the Work from entities involved.
  2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

#### 1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Program Description
1. Use a Critical Path Method (CPM) construction schedule to control the Work and to provide a basis for determining job progress.
  2. Perform all work in accordance with the established CPM schedule.
  3. The construction schedule.
  4. Software prepared CPM network (diagram of activities) presented in a time-scaled graphic (print-out) with reports, as specified herein.

- B. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- C. Qualifications:
  - 1. Within seven days of the award of contract, provide a résumé or qualifications statement for the individual within the Contractor's organization, or the outside consultant, who is being proposed as the responsible party for development and maintenance of the CPM schedule.
  - 2. Demonstrate that the proposed responsible party has successfully developed and maintained CPM schedules for at least three construction projects of the same size or greater than this project.
  - 3. The proposed responsible party for the CPM schedule is subject to approval by the Engineer and Owner.
- D. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
  - 1. Do not change Contract completion date, unless specifically authorized by Change Order.
- E. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
  - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Engineer.
  - 2. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule.
  - 3. Procurement cycle activities: Submittals, approvals, purchasing, fabrication, and delivery.
    - a. Owner-furnished single-stage blowers, starters, and control panels.
  - 4. Submittal Review Time: Include review and resubmittal times indicated in Section 01330 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
  - 5. Startup and Testing Time: Coordinate startup and testing durations with equipment manufacturer(s).
  - 6. Commissioning Time: Include no fewer than 7 days for commissioning.
  - 7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.
  - 8. Punch List and Final Completion: Include not more than 14 days for completion of punch list items and Final Completion.
- F. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
  - 1. Phasing: Arrange list of activities on schedule by phase.

2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01110 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Mockups.
    - e. Fabrication.
    - f. Sample testing.
    - g. Deliveries.
    - h. Installation.
    - i. Tests and inspections.
    - j. Adjusting.
    - k. Curing.
    - l. Building flush-out.
    - m. Startup and placement into final use and operation.
    - n. Commissioning.
- G. Milestones: Include at a minimum: , Notice to Proceed, Substantial Completion, and Final Completion, and the following interim milestones:
1. Each plant shut-down for tie-in of new equipment.
- H. Acceptability:
1. The Engineer's review of the Contractor's construction schedule submittals:
    - a. Including but not limited to contract time and work sequences specified in the contract documents.
    - b. Does not include the Contractor's means and methods of construction or safety.
    - c. The Engineer's concurrence, acceptance, or approval of the Contractor's schedule submittals will not relieve the Contractor from responsibility for complying with the Contract Scope, Contract Time or any other contract requirement.
    - d. Indication of concurrence, acceptance, or approval of the Contractor's schedule will only indicate a general conformance with the Contract Requirements.
  2. Failure to include any element of work required for the performance of this Contract will not excuse the Contractor from completing all Work required within the Contract completion date(s), notwithstanding the review of the network by the Engineer.
  3. CPM schedules that contain activities with negative float, or which extend beyond the contract completion date, will not be acceptable.
  4. Except where earlier completions are specified, CPM schedules which show completion of all work prior to the contract completion date may be indicated; however, in no event shall they constitute a basis for claim for delay by the Contractor.

- I. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule prior to each regularly scheduled progress meeting.
  - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
- J. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- K. Contract Completion Time:
  - 1. Adjusted only for causes specified in this Contract.
  - 2. If requesting an extension of any contract completion date, provide justification and supporting evidence as the Engineer may deem necessary to determine whether an extension of time under the provisions of this Contract is justified.
  - 3. The Engineer will, after receipt of such justification and supporting evidence, make findings of fact and will advise in writing thereof.
  - 4. If the Engineer determines an extension of any contract completion date is entitled, the Engineer's determination as to the total number of days extension are to be based upon the currently approved CPM schedule and on all data relevant to the extension.
  - 5. Include relevant data in the next updating of the schedule. Actual delays in activities which, according to the CPM schedule, do not affect any contract completion date shown by the critical path in the network will not be the basis for a change therein.
- L. Distribution: Distribute copies of approved schedule to Engineer, Owner, and other parties identified by Contractor with a need-to-know schedule responsibility.

## 1.8 CPM SCHEDULE REQUIREMENTS

- A. Prepare network diagrams using AON (activity-on-node) format.
- B. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.
  - 1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 14 days after date established for the Notice to Proceed.
  - 2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  - 3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.
- C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.



1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
  - a. Preparation and processing of submittals.
  - b. Mobilization and demobilization.
  - c. Purchase of materials.
  - d. Delivery.
  - e. Fabrication.
  - f. Utility interruptions.
  - g. Installation.
  - h. Work by Owner that may affect or be affected by Contractor's activities.
  - i. Testing and inspection.
  - j. Commissioning.
  - k. Punch list and Final Completion.
  - l. Activities occurring following Final Completion.
  - m. Maintenance of existing facilities.
  - n. Contract milestones.
2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
  - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities.
- F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
  1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.
  5. Changes in the critical path.
  6. Changes in total float or slack time.
  7. Changes in the Contract Time.

## 1.9 CONSTRUCTION SCHEDULING GENERAL PROVISIONS

- A. If night work is required, the Contractor shall coordinate with the Owner for permission. Such permission, however, may be revoked at any time by the Owner if the Contractor fails to maintain adequate lighting equipment, and supervision for the proper prosecution and control of the work at night, or if the off-site effects of night construction are deemed by the Owner to be unacceptable.
- B. Due to the potential health hazards, and requirements of the State of Texas and the U.S. Environmental Protection Agency, wastewater treatment facilities must be maintained in operation throughout the construction period.
- C. Areas of construction under this contract must be coordinated with the Plant Operating Personnel and accomplished in a logical order to maintain the process flow through the plant and to allow construction to be completed within the time allowed by Contract Documents. Coordinate the activities with the other contractors, if any, to allow orderly and timely completion of all the work.
- D. When access through construction areas must be disrupted, provide alternate acceptable access for the plant operators.
- E. Coordinate the activities in the interface or common areas with the plant operators. Submit to the Engineer a description and schedule as to how the common areas will be utilized, recognizing the required coordination with the plant operators.
- F. Sequencing of work will depend on the closure of various valves. Only Plant Operation Personnel may close or open existing valves.
- G. Sequencing of work will require temporary partial power shutdown. Make every effort necessary to minimize the shutdown time and coordinate with the Plant Operating Personnel and/or utility authorities prior to attempting any such power shutdown or provide any corrective measure or temporary facilities necessary to perform the work at no additional cost to the Owner and without interrupting the plant operation.
- H. When the work requires an existing facility to be taken out of operation, temporarily or permanently, notify the Engineer and Owner one week in advance.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01320

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## SECTION 01323 - PHOTOGRAPHIC DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Preconstruction photographs.
  - 2. Concealed Work photographs.
  - 3. Periodic construction photographs.
  - 4. Final Completion construction photographs.
- B. Related Requirements:
  - 1. Section 01770 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
  - 2. Section 01790 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
  - 3. Section 02222 "Selective Demolition" for photographic documentation before selective demolition operations commence.
  - 4. Section 02200 "Site Clearing" for photographic documentation before site clearing operations commence.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
  - 1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
  - 2. Identification: Provide the following information with each image by naming convention or description in web-based Project management software site:
    - a. Date photograph was taken.
    - b. Description of location, vantage point, and direction.
    - c. Unique sequential identifier keyed to accompanying key plan.

#### 1.4 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 10 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- C. File Names: Name media files with date, project area and sequential numbering suffix.
- D. Usage Rights:
  - 1. Posting images to web-based project management software is understood to transfer copyright usage rights from photographer to Owner and Engineer for unlimited reproduction of photographic documentation.

#### 1.5 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs with maximum depth of field and in focus.
  - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Preconstruction Photographs: Before commencement of the Work take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Engineer.
  - 1. Flag construction limits before taking construction photographs.
  - 2. Take an adequate number of photographs (minimum of 20) to show existing conditions in and around each work area, locations for staging and temporary facilities, and of each existing structure where work will be performed before starting the Work.
  - 3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- C. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
  - 1. Underground utilities.
  - 2. Underslab services.
  - 3. Piping.
  - 4. Electrical conduit.
  - 5. Waterproofing and weather-resistant barriers.
  - 6. Completed mechanical installations that will be submerged after start-up.
- D. Periodic Construction Photographs: Take an appropriate number of photographs coinciding with the cutoff date associated with each Application for Payment to document work progress. Select vantage points to show status of construction and progress since last photographs were taken.

- E. Final Completion Construction Photographs: Take an adequate number of photographs (minimum of 20) photographs after date of Substantial Completion to show extent of completed work for submission as Project Record Documents. Coordinate with Owner and Engineer during Project Closeout Conference for desired vantage points.
- F. Additional Photographs: Engineer may request photographs in addition to periodic photographs specified.
  - 1. Three days' notice will be given, where feasible.
  - 2. In emergency situations, take additional photographs within 24 hours of request.
  - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
    - a. Immediate follow-up when on-site events result in construction damage or losses.
    - b. Documentation of fabrication or storage of materials/equipment at locations away from Project site.
    - c. Substantial Completion of a major phase or component of the Work.
    - d. Extra record photographs at time of final acceptance.
    - e. Owner's request for special publicity photographs.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01323

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## SECTION 01330 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Submittal schedule requirements.
- 2. Administrative and procedural requirements for submittals.

- B. Related Requirements:

- 1. Section 01290 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
- 2. Section 01310 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
- 3. Section 01320 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
- 4. Section 01323 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
- 5. Section 01400 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
- 6. Section 01770 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
- 7. Section 01782 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
- 8. Section 01783 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
- 9. Section 01790 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

#### 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with



requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

#### 1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  2. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
    - b. Specification Section number and title.
    - c. Submittal Category: Action; informational.
    - d. Name of subcontractor.
    - e. Description of the Work covered.
    - f. Scheduled date for Engineer's final release or approval.
    - g. Scheduled dates for purchasing.
    - h. Scheduled date of fabrication.
    - i. Scheduled dates for installation.

#### 1.5 SUBMITTAL FORMATS

- A. Numbering System: Utilize the following example submittal identification numbering system to identify submittals and as file names for PDF submissions:
1. First Identifier - Alphabet Character: D, S, M or I which represents Shop Drawing (including working drawings and product data), Sample, Manual (Operating & Maintenance) or Informational, respectively.
  2. Second Identifier - Next 6 or 8 Digits: Applicable Specification Section Number. Do not mix submittals from different specification sections into a single submittal.
  3. Third Identifier - Next Three Digits: Sequential number of each separate item or drawing submitted under each Specification Section, in chronological order submitted, starting at 001.
  4. Fourth Identifier - Last Alphabet Character: A to Z, indicating the submission (or resubmission) of the same submittal, i.e., "A" = 1st submission, "B" = 2nd submission, "C" = 3rd submission, etc.
  5. EXAMPLE: D-03300.13-008-B.
    - a. D = Shop Drawing.
    - b. 03 30 00.13 = Section; use only 6 digits for sections that do not include 8 digits.
    - c. 008 = the eighth different submittal under this Section.
    - d. B = the second submission (first resubmission) of that particular shop drawing.

- B. Submittal Information: Include the following information in each submittal:
1. Project name.
  2. Date.
  3. Name of Engineer.
  4. Name of Construction Manager.
  5. Name of Contractor.
  6. Name of firm or entity that prepared submittal.
  7. Names of subcontractor, manufacturer, and supplier.
  8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
  9. Category and type of submittal.
  10. Submittal purpose and description.
  11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
  12. Drawing number and detail references, as appropriate.
  13. Indication of full or partial submittal.
  14. Location(s) where product is to be installed, as appropriate.
  15. Other necessary identification.
  16. Remarks.
  17. Signature of transmitter.
- C. Options: Identify options requiring selection by Engineer.
- D. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- E. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

## 1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
  - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  1. Initial Review: Allow 21 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
  1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.
  4. Repetitive Reviews: Shop drawings, O&M manuals, and other submittals will be reviewed no more than twice at the Owner's expense. All subsequent reviews will be performed at the Contractor's expense. Reimburse the Owner for all costs invoiced by Engineer for the third and subsequent reviews.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

## 1.7 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.

- c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams that show factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Engineer's digital data drawing files is otherwise permitted.
  1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 11 by 17 inches.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
  1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    - a. Project name and submittal number.
    - b. Generic description of Sample.
    - c. Product name and name of manufacturer.
    - d. Sample source.
    - e. Number and title of applicable Specification Section.
    - f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
  4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
  5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return submittal with options selected.
  7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    - a. Number of Samples: Submit three sets of Samples. Engineer will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
      - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
  2. Manufacturer and product name, and model number if applicable.
  3. Number and name of room or space.
  4. Location within room or space.

- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
  - 1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
  - 2. Contractor's Certification: Each shop drawing, working drawing, product data, and sample shall have affixed to it the following Certification Statement:
    - a. "Certification Statement: by this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements. "
  - 3. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
  - 4. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
  - 5. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
  - 6. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
  - 7. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
  - 1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
  - 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
  - 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - a. Name of evaluation organization.
  - b. Date of evaluation.
  - c. Time period when report is in effect.
  - d. Product and manufacturers' names.
  - e. Description of product.
  - f. Test procedures and results.
  - g. Limitations of use.

#### 1.8 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Engineer.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

#### 1.9 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Contractor Responsible for:
  1. Determination and verification of materials including manufacturer's catalog numbers.
  2. Determination and verification of field measurements and field construction criteria.

3. Checking and coordinating information in submittal with requirements of Work and of Contract Documents.
  4. Determination of accuracy and completeness of dimensions and quantities.
  5. Confirmation and coordination of dimensions and field conditions at Site.
  6. Construction means, techniques, sequences, and procedures.
  7. Safety precautions.
  8. Coordination and performance of Work of all trades.
  9. Other requirements enumerated in Contract Documents.
- C. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
1. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.

#### 1.10 ENGINEER'S REVIEW

- A. Do not make mass submittals to Engineer. If mass submittals are received, Engineer's review time stated above will be extended as necessary to perform proper review. Engineer will review mass submittals based on priority determined by Engineer after consultation with Owner and Contractor.
- B. Action Submittals: Engineer will review each submittal, indicate corrections or revisions required.
- C. PDF Submittals: Engineer will indicate, via comment response form and/or markup on each submittal, the appropriate action. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.
- E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- F. Engineer will discard submittals received from sources other than Contractor.
- G. Submittals not required by the Contract Documents will be returned by Engineer without action.
- H. Shop drawings will be returned to the Contractor with one of the following codes.
  1. "APPROVED" - This code is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.
  2. "APPROVED AS NOTED" - This code is assigned when a confirmation of the notations and comments IS NOT required by the Contractor. The Contractor may release the



- equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.
3. "APPROVED AS NOTED/RESUBMIT" - This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the package. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. The resubmittal is to address all comments, omissions and non-conforming items that were noted. An additional box is checked to indicate whether the resubmission is for the complete package, or for parts of the package. If no box is checked, a complete resubmittal shall be provided. Review code may designate if a partial or full submittal is required. If full submittal is required, a complete resubmittal package addressing all comments shall be provided. If a partial submittal is designated, resubmittal shall only include information pertaining to those items noted in review comments requiring clarification and any portions of submittal impacted as a result of the response. Resubmittal is to be received by the Engineer within 30 calendar days of the date of the Engineer's transmittal requiring the resubmittal.
  4. "REJECTED" - This code is assigned when the submittal does not meet the intent of the Contract Documents. The Contractor must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the requirements of the Contract Documents.
  5. "RECEIPT ACKNOWLEDGED (Not subject to Engineer's Approval)" - This code is assigned to acknowledge receipt of a submittal that is not subject to the Engineer's approval. This code is generally used with submittals involving the Contractor's means and methods of construction work plans, and health and safety plans.

#### 1.11 ELECTRONIC CAD FILES OF PROJECT DRAWINGS

- A. Electronic CAD Files of Project Drawings: May only be used to expedite production of Shop Drawings for the Project. Use for other Projects or purposes is not allowed.
- B. Electronic CAD Files of Project Drawings: Distributed only under the following conditions:
  1. Use of files is solely at receiver's risk. Engineer does not warrant accuracy of files. Receiving files in electronic form does not relieve receiver of responsibilities for measurements, dimensions, and quantities set forth in Contract Documents. In the event of ambiguity, discrepancy, or conflict between information on electronic media and that in Contract Documents, notify Engineer of discrepancy and use information in hard-copy Drawings and Specifications.
  2. CAD files do not necessarily represent the latest Contract Documents, existing conditions, and as-built conditions. Receiver is responsible for determining and complying with these conditions and for incorporating addenda and modifications.
  3. User is responsible for removing information not normally provided on Shop Drawings and removing references to Contract Documents. Shop Drawings submitted with information associated with other trades or with references to Contract Documents will not be reviewed and will be immediately returned.
  4. Receiver shall not hold Engineer responsible for data or file clean-up required to make files usable, nor for error or malfunction in translation, interpretation, or use of this electronic information.

5. Receiver shall understand that even though Engineer has computer virus scanning software to detect presence of computer viruses, there is no guarantee that computer viruses are not present in files or in electronic media.
6. Receiver shall not hold Engineer responsible for such viruses or their consequences, and shall hold Engineer harmless against costs, losses, or damage caused by presence of computer virus in files or media.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01330

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## SECTION 01400 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Requirements:
  - 1. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities.
  - 2. Respective Sections of Specifications: Certification of products.
  - 3. Refer Bid Form for testing and inspection allowances.

#### 1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."
- H. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Engineer.

#### 1.4 DELEGATED-DESIGN SERVICES

- A. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

#### 1.5 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Engineer regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Engineer for clarification before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits.

To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
  - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
  - 2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Entity responsible for performing tests and inspections.
  - 3. Description of test and inspection.
  - 4. Identification of applicable standards.
  - 5. Identification of test and inspection methods.
  - 6. Number of tests and inspections required.
  - 7. Time schedule or time span for tests and inspections.
  - 8. Requirements for obtaining samples.
  - 9. Unique characteristics of each quality-control service.
- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

## 1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Engineer. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to

coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.

- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
  - 1. Project quality-control manager.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
  - 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
  - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
  - 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include Work Engineer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

## 1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, telephone number, and email address of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of technical representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement of whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
  2. Statement that equipment complies with requirements.
  3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  4. Statement of whether conditions, products, and installation will affect warranty.
  5. Other required items indicated in individual Specification Sections.

## 1.9 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- D. **Installer Qualifications:** A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. **Design Professional Qualifications:** A professional engineer / registered architect who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Design / engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. **Specialists:** Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged in the activities indicated.
  - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. **Testing and Inspecting Agency Qualifications:** An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. **Manufacturer's Technical Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect, demonstrate, repair and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. **Factory-Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. **Preconstruction Testing:** Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods. Contractor responsibilities include the following:
  - 1. Provide test specimens representative of proposed products and construction.
  - 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
  - 3. Provide sizes and configurations of test assemblies to adequately demonstrate capability of products to comply with performance requirements.
  - 4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
  - 5. When testing is complete, remove test specimens and test assemblies, do not reuse products on Project.
  - 6. **Testing Agency Responsibilities:** Submit a certified written report of each test, inspection, and similar quality-assurance service to Engineer, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.



## 1.10 QUALITY CONTROL

- A. **Owner Responsibilities:** Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
  2. Payment for these services will be made from testing and inspection allowances specified in Section 01210 "Allowances," as authorized by Change Orders.
  3. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.
- B. **Contractor Responsibilities:** Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  2. Engage a qualified testing agency to perform quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
  4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. **Testing Agency Responsibilities:** Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01330 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
  1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
  1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payments.
  1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
  2. Distribution: Distribute schedule to Owner, Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

#### 1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Engineer and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Engineer with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
  1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.
  3. Date test or inspection results were transmitted to Engineer.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.
  1. Submit log at Project closeout as part of Project Record Documents.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01730 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01400



## SECTION 01420 - REFERENCES

### 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 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

#### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

#### 1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. **[Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."]** The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.
  - 1. AABC - Associated Air Balance Council; [www.aabc.com](http://www.aabc.com).
  - 2. AAMA - American Architectural Manufacturers Association; [www.aamanet.org](http://www.aamanet.org).
  - 3. AAPFCO - Association of American Plant Food Control Officials; [www.aapfco.org](http://www.aapfco.org).
  - 4. AASHTO - American Association of State Highway and Transportation Officials; [www.transportation.org](http://www.transportation.org).
  - 5. AATCC - American Association of Textile Chemists and Colorists; [www.aatcc.org](http://www.aatcc.org).
  - 6. ABMA - American Bearing Manufacturers Association; [www.americanbearings.org](http://www.americanbearings.org).
  - 7. ABMA - American Boiler Manufacturers Association; [www.abma.com](http://www.abma.com).
  - 8. ACI - American Concrete Institute; (Formerly: ACI International); [www.concrete.org](http://www.concrete.org)
  - 9. ACPA - American Concrete Pipe Association; [www.concrete-pipe.org](http://www.concrete-pipe.org).
  - 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); [www.aeic.org](http://www.aeic.org).
  - 11. AF&PA - American Forest & Paper Association; [www.afandpa.org](http://www.afandpa.org).
  - 12. AGA - American Gas Association; [www.aga.org](http://www.aga.org).
  - 13. AHAM - Association of Home Appliance Manufacturers; [www.aham.org](http://www.aham.org).
  - 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); [www.ahrinet.org](http://www.ahrinet.org).
  - 15. AI - Asphalt Institute; [www.asphaltinstitute.org](http://www.asphaltinstitute.org).
  - 16. AIA - American Institute of Architects (The); [www.aia.org](http://www.aia.org).
  - 17. AISC - American Institute of Steel Construction; [www.aisc.org](http://www.aisc.org).
  - 18. AISI - American Iron and Steel Institute; [www.steel.org](http://www.steel.org).
  - 19. AITC - American Institute of Timber Construction; [www.aitc-glulam.org](http://www.aitc-glulam.org).
  - 20. AMCA - Air Movement and Control Association International, Inc.; [www.amca.org](http://www.amca.org).
  - 21. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
  - 22. AOSA - Association of Official Seed Analysts, Inc.; [www.aosaseed.com](http://www.aosaseed.com).
  - 23. APA - APA - The Engineered Wood Association; [www.apawood.org](http://www.apawood.org).
  - 24. APA - Architectural Precast Association; [www.archprecast.org](http://www.archprecast.org).

25. API - American Petroleum Institute; [www.api.org](http://www.api.org).
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; [www.asphaltroofing.org](http://www.asphaltroofing.org).
29. ASCE - American Society of Civil Engineers; [www.asce.org](http://www.asce.org).
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; [www.ashrae.org](http://www.ashrae.org).
32. ASME - ASME International; (American Society of Mechanical Engineers); [www.asme.org](http://www.asme.org).
33. ASSE - American Society of Safety Engineers (The); [www.asse.org](http://www.asse.org).
34. ASSE - American Society of Sanitary Engineering; [www.asse-plumbing.org](http://www.asse-plumbing.org).
35. ASTM - ASTM International; [www.astm.org](http://www.astm.org).
36. ATIS - Alliance for Telecommunications Industry Solutions; [www.atis.org](http://www.atis.org).
37. AWEA - American Wind Energy Association; [www.awea.org](http://www.awea.org).
38. AWI - Architectural Woodwork Institute; [www.awinet.org](http://www.awinet.org).
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; [www.awmac.com](http://www.awmac.com).
40. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).
41. AWS - American Welding Society; [www.aws.org](http://www.aws.org).
42. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).
43. BHMA - Builders Hardware Manufacturers Association; [www.buildershardware.com](http://www.buildershardware.com).
44. BIA - Brick Industry Association (The); [www.gobrick.com](http://www.gobrick.com).
45. BICSI - BICSI, Inc.; [www.bicsi.org](http://www.bicsi.org).
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); [www.bifma.org](http://www.bifma.org).
47. BISSC - Baking Industry Sanitation Standards Committee; [www.bissc.org](http://www.bissc.org).
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); [www.bissc.org](http://www.bissc.org).
49. CDA - Copper Development Association; [www.copper.org](http://www.copper.org).
50. CE - Conformite Europeenne; <http://ec.europa.eu/growth/single-market/ce-marking/>
51. CEA - Canadian Electricity Association; [www.electricity.ca](http://www.electricity.ca).
52. CEA - Consumer Electronics Association; [www.ce.org](http://www.ce.org).
53. CFFA - Chemical Fabrics and Film Association, Inc.; [www.chemicalfabricsandfilm.com](http://www.chemicalfabricsandfilm.com).
54. CFSEI - Cold-Formed Steel Engineers Institute; [www.cfsei.org](http://www.cfsei.org).
55. CGA - Compressed Gas Association; [www.cganet.com](http://www.cganet.com).
56. CIMA - Cellulose Insulation Manufacturers Association; [www.cellulose.org](http://www.cellulose.org).
57. CISCA - Ceilings & Interior Systems Construction Association; [www.cisca.org](http://www.cisca.org).
58. CISPI - Cast Iron Soil Pipe Institute; [www.cispi.org](http://www.cispi.org).
59. CLFMI - Chain Link Fence Manufacturers Institute; [www.chainlinkinfo.org](http://www.chainlinkinfo.org).
60. CPA - Composite Panel Association; [www.pbmdf.com](http://www.pbmdf.com).
61. CRI - Carpet and Rug Institute (The); [www.carpet-rug.org](http://www.carpet-rug.org).
62. CRRC - Cool Roof Rating Council; [www.coolroofs.org](http://www.coolroofs.org).
63. CRSI - Concrete Reinforcing Steel Institute; [www.crsi.org](http://www.crsi.org).
64. CSA - CSA Group; [www.csagroup.com](http://www.csagroup.com).
65. CSA - CSA International; [www.csa-international.org](http://www.csa-international.org).
66. CSI - Construction Specifications Institute (The); [www.csinet.org](http://www.csinet.org).
67. CSSB - Cedar Shake & Shingle Bureau; [www.cedarbureau.org](http://www.cedarbureau.org).
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); [www.cti.org](http://www.cti.org).
69. CWC - Composite Wood Council; (See CPA).

70. DASMA - Door and Access Systems Manufacturers Association; [www.dasma.com](http://www.dasma.com).
71. DHI - Door and Hardware Institute; [www.dhi.org](http://www.dhi.org).
72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
74. ECIA - Electronic Components Industry Association; [www.eciaonline.org](http://www.eciaonline.org).
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; [www.eima.com](http://www.eima.com).
77. EJMA - Expansion Joint Manufacturers Association, Inc.; [www.ejma.org](http://www.ejma.org).
78. ESD - ESD Association; (Electrostatic Discharge Association); [www.esda.org](http://www.esda.org).
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. ETL - Intertek (See Intertek); [www.intertek.com](http://www.intertek.com).
81. EVO - Efficiency Valuation Organization; [www.evo-world.org](http://www.evo-world.org).
82. FCI - Fluid Controls Institute; [www.fluidcontrolsinstitute.org](http://www.fluidcontrolsinstitute.org).
83. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); [www.fiba.com](http://www.fiba.com).
84. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); [www.fivb.org](http://www.fivb.org).
85. FM Approvals - FM Approvals LLC; [www.fmglobal.com](http://www.fmglobal.com).
86. FM Global - FM Global; (Formerly: FMG - FM Global); [www.fmglobal.com](http://www.fmglobal.com).
87. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; [www.floridarroof.com](http://www.floridarroof.com).
88. FSA - Fluid Sealing Association; [www.fluidsealing.com](http://www.fluidsealing.com).
89. FSC - Forest Stewardship Council U.S.; [www.fscus.org](http://www.fscus.org).
90. GA - Gypsum Association; [www.gypsum.org](http://www.gypsum.org).
91. GANA - Glass Association of North America; [www.glasswebsite.com](http://www.glasswebsite.com).
92. GS - Green Seal; [www.greenseal.org](http://www.greenseal.org).
93. HI - Hydraulic Institute; [www.pumps.org](http://www.pumps.org).
94. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
95. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
96. HPVA - Hardwood Plywood & Veneer Association; [www.hpva.org](http://www.hpva.org).
97. HPW - H. P. White Laboratory, Inc.; [www.hpwhite.com](http://www.hpwhite.com).
98. IAPSC - International Association of Professional Security Consultants; [www.iapsc.org](http://www.iapsc.org).
99. IAS - International Accreditation Service; [www.iasonline.org](http://www.iasonline.org).
100. ICBO - International Conference of Building Officials; (See ICC).
101. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
102. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
103. ICPA - International Cast Polymer Alliance; [www.icpa-hq.org](http://www.icpa-hq.org).
104. ICRI - International Concrete Repair Institute, Inc.; [www.icri.org](http://www.icri.org).
105. IEC - International Electrotechnical Commission; [www.iec.ch](http://www.iec.ch).
106. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
107. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); [www.ies.org](http://www.ies.org).
108. IESNA - Illuminating Engineering Society of North America; (See IES).
109. IEST - Institute of Environmental Sciences and Technology; [www.iest.org](http://www.iest.org).
110. IGMA - Insulating Glass Manufacturers Alliance; [www.igmaonline.org](http://www.igmaonline.org).
111. IGSHPA - International Ground Source Heat Pump Association; [www.igshpa.okstate.edu](http://www.igshpa.okstate.edu).
112. ILI - Indiana Limestone Institute of America, Inc.; [www.iliai.com](http://www.iliai.com).
113. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); [www.intertek.com](http://www.intertek.com).



114. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); [www.isa.org](http://www.isa.org).
115. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
116. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); [www.isfanow.org](http://www.isfanow.org).
117. ISO - International Organization for Standardization; [www.iso.org](http://www.iso.org).
118. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
119. ITU - International Telecommunication Union; [www.itu.int/home](http://www.itu.int/home).
120. KCMA - Kitchen Cabinet Manufacturers Association; [www.kcma.org](http://www.kcma.org).
121. LMA - Laminating Materials Association; (See CPA).
122. LPI - Lightning Protection Institute; [www.lightning.org](http://www.lightning.org).
123. MBMA - Metal Building Manufacturers Association; [www.mbma.com](http://www.mbma.com).
124. MCA - Metal Construction Association; [www.metalconstruction.org](http://www.metalconstruction.org).
125. MFMA - Maple Flooring Manufacturers Association, Inc.; [www.maplefloor.org](http://www.maplefloor.org).
126. MFMA - Metal Framing Manufacturers Association, Inc.; [www.metalframingmfg.org](http://www.metalframingmfg.org).
127. MHIA - Material Handling Industry of America; [www.mhia.org](http://www.mhia.org).
128. MIA - Marble Institute of America; [www.marble-institute.com](http://www.marble-institute.com).
129. MMPA - Moulding & Millwork Producers Association; [www.wmmpa.com](http://www.wmmpa.com).
130. MPI - Master Painters Institute; [www.paintinfo.com](http://www.paintinfo.com).
131. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; [www.mss-hq.org](http://www.mss-hq.org).
132. NAAMM - National Association of Architectural Metal Manufacturers; [www.naamm.org](http://www.naamm.org).
133. NACE - NACE International; (National Association of Corrosion Engineers International); [www.nace.org](http://www.nace.org).
134. NADCA - National Air Duct Cleaners Association; [www.nadca.com](http://www.nadca.com).
135. NAIMA - North American Insulation Manufacturers Association; [www.naima.org](http://www.naima.org).
136. NBGQA - National Building Granite Quarries Association, Inc.; [www.nbgqa.com](http://www.nbgqa.com).
137. NBI - New Buildings Institute; [www.newbuildings.org](http://www.newbuildings.org).
138. NCAA - National Collegiate Athletic Association (The); [www.ncaa.org](http://www.ncaa.org).
139. NCMA - National Concrete Masonry Association; [www.ncma.org](http://www.ncma.org).
140. NEBB - National Environmental Balancing Bureau; [www.nebb.org](http://www.nebb.org).
141. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
142. NeLMA - Northeastern Lumber Manufacturers Association; [www.nelma.org](http://www.nelma.org).
143. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
144. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
145. NFHS - National Federation of State High School Associations; [www.nfhs.org](http://www.nfhs.org).
146. NFPA - National Fire Protection Association; [www.nfpa.org](http://www.nfpa.org).
147. NFPA - NFPA International; (See NFPA).
148. NFRC - National Fenestration Rating Council; [www.nfrc.org](http://www.nfrc.org).
149. NHLA - National Hardwood Lumber Association; [www.nhla.com](http://www.nhla.com).
150. NLGA - National Lumber Grades Authority; [www.nlga.org](http://www.nlga.org).
151. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
152. NOMMA - National Ornamental & Miscellaneous Metals Association; [www.nomma.org](http://www.nomma.org).
153. NRCA - National Roofing Contractors Association; [www.nrca.net](http://www.nrca.net).
154. NRMCA - National Ready Mixed Concrete Association; [www.nrmca.org](http://www.nrmca.org).
155. NSF - NSF International; [www.nsf.org](http://www.nsf.org).
156. NSPE - National Society of Professional Engineers; [www.nspe.org](http://www.nspe.org).
157. NSSGA - National Stone, Sand & Gravel Association; [www.nssga.org](http://www.nssga.org).
158. NTMA - National Terrazzo & Mosaic Association, Inc. (The); [www.ntma.com](http://www.ntma.com).
159. NWFA - National Wood Flooring Association; [www.nwfa.org](http://www.nwfa.org).

160. PCI - Precast/Prestressed Concrete Institute; [www.pci.org](http://www.pci.org).
161. PDI - Plumbing & Drainage Institute; [www.pdionline.org](http://www.pdionline.org).
162. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); [www.plasa.org](http://www.plasa.org).
163. RCSC - Research Council on Structural Connections; [www.boltcouncil.org](http://www.boltcouncil.org).
164. RFCI - Resilient Floor Covering Institute; [www.rfci.com](http://www.rfci.com).
165. RIS - Redwood Inspection Service; [www.redwoodinspection.com](http://www.redwoodinspection.com).
166. SAE - SAE International; [www.sae.org](http://www.sae.org).
167. SCTE - Society of Cable Telecommunications Engineers; [www.scte.org](http://www.scte.org).
168. SDI - Steel Deck Institute; [www.sdi.org](http://www.sdi.org).
169. SDI - Steel Door Institute; [www.steeldoor.org](http://www.steeldoor.org).
170. SEFA - Scientific Equipment and Furniture Association (The); [www.sefalabs.com](http://www.sefalabs.com).
171. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
172. SIA - Security Industry Association; [www.siaonline.org](http://www.siaonline.org).
173. SJI - Steel Joist Institute; [www.steeljoist.org](http://www.steeljoist.org).
174. SMA - Screen Manufacturers Association; [www.smainfo.org](http://www.smainfo.org).
175. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; [www.smacna.org](http://www.smacna.org).
176. SMPTE - Society of Motion Picture and Television Engineers; [www.smpte.org](http://www.smpte.org).
177. SPFA - Spray Polyurethane Foam Alliance; [www.sprayfoam.org](http://www.sprayfoam.org).
178. SPIB - Southern Pine Inspection Bureau; [www.spib.org](http://www.spib.org).
179. SPRI - Single Ply Roofing Industry; [www.spri.org](http://www.spri.org).
180. SRCC - Solar Rating & Certification Corporation; [www.solar-rating.org](http://www.solar-rating.org).
181. SSINA - Specialty Steel Industry of North America; [www.ssina.com](http://www.ssina.com).
182. SSPC - SSPC: The Society for Protective Coatings; [www.sspc.org](http://www.sspc.org).
183. STI - Steel Tank Institute; [www.steeltank.com](http://www.steeltank.com).
184. SWI - Steel Window Institute; [www.steelwindows.com](http://www.steelwindows.com).
185. SWPA - Submersible Wastewater Pump Association; [www.swpa.org](http://www.swpa.org).
186. TCA - Tilt-Up Concrete Association; [www.tilt-up.org](http://www.tilt-up.org).
187. TCNA - Tile Council of North America, Inc.; [www.tileusa.com](http://www.tileusa.com).
188. TEMA - Tubular Exchanger Manufacturers Association, Inc.; [www.tema.org](http://www.tema.org).
189. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); [www.tiaonline.org](http://www.tiaonline.org).
190. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
191. TMS - The Masonry Society; [www.masonrysociety.org](http://www.masonrysociety.org).
192. TPI - Truss Plate Institute; [www.tpinst.org](http://www.tpinst.org).
193. TPI - Turfgrass Producers International; [www.turfgrasssod.org](http://www.turfgrasssod.org).
194. TRI - Tile Roofing Institute; [www.tilerroofing.org](http://www.tilerroofing.org).
195. UL - Underwriters Laboratories Inc.; <http://www.ul.com>.
196. UNI - Uni-Bell PVC Pipe Association; [www.uni-bell.org](http://www.uni-bell.org).
197. USAV - USA Volleyball; [www.usavolleyball.org](http://www.usavolleyball.org).
198. USGBC - U.S. Green Building Council; [www.usgbc.org](http://www.usgbc.org).
199. USITT - United States Institute for Theatre Technology, Inc.; [www.usitt.org](http://www.usitt.org).
200. WA - Wallcoverings Association; [www.wallcoverings.org](http://www.wallcoverings.org).
201. WASTEC - Waste Equipment Technology Association; [www.wastec.org](http://www.wastec.org).
202. WCLIB - West Coast Lumber Inspection Bureau; [www.wclib.org](http://www.wclib.org).
203. WCMA - Window Covering Manufacturers Association; [www.wcmanet.org](http://www.wcmanet.org).
204. WDMA - Window & Door Manufacturers Association; [www.wdma.com](http://www.wdma.com).

205. WI - Woodwork Institute; [www.wicnet.org](http://www.wicnet.org).
206. WSRCA - Western States Roofing Contractors Association; [www.wsrca.com](http://www.wsrca.com).
207. WWPA - Western Wood Products Association; [www.wwpa.org](http://www.wwpa.org).

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut für Normung e.V.; [www.din.de](http://www.din.de).
2. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
3. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
4. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; [www.usace.army.mil](http://www.usace.army.mil).
2. CPSC - Consumer Product Safety Commission; [www.cpsc.gov](http://www.cpsc.gov).
3. DOC - Department of Commerce; National Institute of Standards and Technology; [www.nist.gov](http://www.nist.gov).
4. DOD - Department of Defense; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
5. DOE - Department of Energy; [www.energy.gov](http://www.energy.gov).
6. EPA - Environmental Protection Agency; [www.epa.gov](http://www.epa.gov).
7. FAA - Federal Aviation Administration; [www.faa.gov](http://www.faa.gov).
8. FG - Federal Government Publications; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
9. GSA - General Services Administration; [www.gsa.gov](http://www.gsa.gov).
10. HUD - Department of Housing and Urban Development; [www.hud.gov](http://www.hud.gov).
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; [www.eetd.lbl.gov](http://www.eetd.lbl.gov).
12. OSHA - Occupational Safety & Health Administration; [www.osha.gov](http://www.osha.gov).
13. SD - Department of State; [www.state.gov](http://www.state.gov).
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; [www.trb.org](http://www.trb.org).
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; [www.ars.usda.gov](http://www.ars.usda.gov).
16. USDA - Department of Agriculture; Rural Utilities Service; [www.usda.gov](http://www.usda.gov).
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; [www.ojp.usdoj.gov](http://www.ojp.usdoj.gov).
18. USP - U.S. Pharmacopeial Convention; [www.usp.org](http://www.usp.org).
19. USPS - United States Postal Service; [www.usps.com](http://www.usps.com).

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).

2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
  3. DSCC - Defense Supply Center Columbus; (See FS).
  4. FED-STD - Federal Standard; (See FS).
  5. FS - Federal Specification; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
    - a. Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil).
    - b. Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).
    - c. Available from National Institute of Building Sciences/Whole Building Design Guide; [www.wbdg.org](http://www.wbdg.org).
  6. MILSPEC - Military Specification and Standards; (See DOD).
  7. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).
  8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; [www.bearhfti.ca.gov](http://www.bearhfti.ca.gov).
  2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; [www.calregs.com](http://www.calregs.com).
  3. CDHS; California Department of Health Services; (See CDPH).
  4. CDPH; California Department of Public Health; Indoor Air Quality Program; [www.cal-iaq.org](http://www.cal-iaq.org).
  5. CPUC; California Public Utilities Commission; [www.cpuc.ca.gov](http://www.cpuc.ca.gov).
  6. SCAQMD; South Coast Air Quality Management District; [www.aqmd.gov](http://www.aqmd.gov).
  7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; [www.txforestservation.tamu.edu](http://www.txforestservation.tamu.edu).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01420

## SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
  - 1. Section 01110 "Summary" for work restrictions and limitations on utility interruptions.

#### 1.3 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Engineer and owner.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.
- C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
  - 1. Locations of dust-control partitions at each phase of work.
  - 2. HVAC system isolation schematic drawing.
  - 3. Location of proposed air-filtration system discharge.
  - 4. Waste-handling procedures.
  - 5. Other dust-control measures.

## 1.5 QUALITY ASSURANCE

- A. Temporary facilities shall comply with all applicable state and local ordinances, codes and regulations.
- B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

## 1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum , thick, galvanized-steel, chain-link fabric fencing; minimum high with galvanized-steel pipe posts; minimum OD line posts and OD corner and pull posts, with OD top and bottom rails. Provide galvanized-steel bases for supporting posts.

### 2.2 TEMPORARY FACILITIES

- A. Field Offices, General: It is not expected that a Contractor's field office shall be required. Should Contractor require a field office, provide prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading at location designated by Owner.

## PART 3 - EXECUTION

### 3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
  - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

### 3.2 INSTALLATION, GENERAL

- A. Locate facilities where shown on the Drawings or where they will serve Project adequately and result in minimum interference with performance of the Work.
  - 1. Locate facilities to limit site disturbance as specified in Section 01110 "Summary."

### 3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service, if approved by Owner.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: If approved, connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Final Completion, restore these facilities to condition existing before initial use.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
  - 1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Final Completion, restore these facilities to condition existing before initial use.
- D. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
  - 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- E. Furnish temporary light and power, including 220 Volt service for welding, complete with wiring, lamps and similar equipment as required to adequately light all work areas and with

sufficient power capacity to meet the project needs. Make all necessary arrangements with the local electric company for temporary electric service and pay all expenses in connection therewith.

- F. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- G. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. No land-based telephone line(s) shall be required to be provided for Contractor's use.
  - 1. In a readily accessible location within the Work area, post a list of important telephone numbers.
    - a. Police and fire departments.
    - b. Ambulance service.
    - c. Contractor's home office.
    - d. Contractor's emergency after-hours telephone number.
    - e. Engineer's office.
    - f. Owner's office.
    - g. Principal subcontractors' field and home offices.

### 3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
  - 1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
- B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
  - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
  - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
  - 2. Remove snow and ice as required to minimize accumulations.
- E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
  - 1. Identification Signs: Provide Project identification signs as indicated on Drawings. Signs shall be constructed of A-A Ext – APA grade plywood, 1-in thick. Posts and braces shall be of pressure treated lumber.
  - 2. Maintain and touch up signs, so they are legible at all times.



- F. Waste Disposal Facilities: Comply with requirements specified in Section 01740 "Construction Waste Management and Disposal."
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01730 "Execution."
- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

### 3.5 SECURITY, GENERAL

- A. Protect site, and all Work, materials, equipment, and existing facilities hereon, from actions of the Contractor, and his employees, including all sub-contractors and suppliers, whether engaged in the execution of the Work under this Contract, or engaged in any other activity while present on the site.
- B. Protect property, equipment, assets and employees while on the work site.
- C. No claim shall be made against Owner by reason of any act of an employee or trespasser.
- D. Contractor shall comply with all security measures required by the Owner, including background security checks, vehicle searches, and all other security measures, either required in this Section or as appropriate on the job site. Owner reserves the right to permanently exclude from the site, at any time, any personnel proposed by the Contractor for security reasons, including, but not limited to, failure to comply with City security measures.
- E. Contractor shall be responsible for providing security fencing around the Temporary Field Office Area as shown on the Drawings and as specified herein.
- F. Contractor shall be solely responsible for all security and loss prevention within the Temporary Field Office Area throughout the duration of the Contract.
- G. All Contractor employees and subcontractors must be a U.S. Citizen or have a legal work permit. Each person must also present a valid unexpired U.S. state driver's license or photo identification card. A U.S. issued resident alien card, with photo, passport, or other U.S. state or U.S. federal photo documentation is acceptable to present for identification purposes.
- H. Contractor shall conduct background security checks, to include criminal records and driving records, on all employees at time of hiring and periodically thereafter.
- I. All construction employees must show a valid identification card upon request while working on site.
- J. Each Contractor employee, including subcontractors, must wear a hard hat with proper identification. Each hardhat shall display a distinctive corporate logo to identify the responsible company.

- K. All Contractor deliveries shall occur only during scheduled Contractor working hours, including work time scheduled on Sundays, legal holidays and/or outside of the normal working hours specified in the Supplementary Conditions. No unscheduled, after-hour deliveries are permitted without prior approval of the Engineer. No deliveries shall be permitted at any time that the Contractor is not scheduled to work and on-site.
- L. The Contractor must store all equipment and materials only in those areas designated by the Owner for this purpose. The Owner is neither responsible nor liable for any equipment, materials, or other property of the Contractor.
- M. The Contractor may choose, at his expense, to provide additional security elements as desired to adequately protect his assets on the job site.
- N. Contractor shall not conduct any interviews of potential employees on the plant site. All interviews must be conducted off-site.
- O. The Engineer will, at their discretion, inspect the security facilities and review operations and will report, in writing, to the Contractor the results of such inspections. Upon request of the Engineer, the Contractor shall, within two working days of receipt of the report, identify, in writing, the corrective actions to be taken to address any deficiencies or problems with the work noted in the report. The corrective actions shall be implemented by the Contractor immediately upon direction of the Engineer.
- P. The Contractor shall maintain copies of records, including but not limited to, each of the following items using forms provided by or approved by the Construction Manager:
  - 1. A regularly maintained and updated list of all personnel in possession of Contractor's keys as described in Paragraph 1.08 above.
  - 2. A list of all scheduled site visitors and deliveries associated with the Contractor's Work.
  - 3. A complete record of all reported incidents of injury, fire, or emergency.
  - 4. A complete record of all reported incidents of theft or vandalism.
  - 5. A complete record of all infractions of the Project Rules and Regulations.
- Q. Entry on site for vehicles and mobile equipment and drivers shall be entirely at risk of Contractor, Subcontractors and/or individual seeking such entry.
- R. Drivers/operators shall be fully and currently licensed and/or certified to drive the type of vehicle or to operate the type of equipment brought on-site.
- S. Drivers shall observe and obey all Texas Laws at all times.
- T. The maximum permissible speed on site is 20 MPH, however, speeds much lower than this may be the maximum safe speeds and it is the direct responsibility of the driver to drive at a safe speed in any area at any given time according to the circumstances existing at that time and place.
- U. The movement and parking of vehicles and equipment on site shall be kept to the minimum necessary to meet construction requirements.
- V. All vehicles and loads shall be subject to search by City personnel or other authorized personnel at any location on site at any time.

### 3.6 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
  - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
  - 1. Comply with work restrictions specified in Section 01110 "Summary."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
  - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
  - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
  - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
  - 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- F. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide, install and maintain signage directing occupants to temporary egress.

### 3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  2. Clear snow and ice from all drives, walks and stairs to maintain safe vehicle and pedestrian access to the site and facilities as directed by the Engineer.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Final Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Final Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  2. Just prior to Final Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01770 "Closeout Procedures."

END OF SECTION 01500

## SECTION 01600 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

#### 1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycle contract materials are considered new products, unless indicated otherwise.
  - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in PART 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the

specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
  2. Data indicating compliance with the requirements specified in PART 2 "Comparable Products" Article.
- E. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
  2. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within seven days of receipt of a comparable product request. Engineer will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
    - a. Form of Engineer's Approval of Submittal: As specified in Section 01330 "Submittal Procedures."
    - b. Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.
- F. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01330 "Submittal Procedures." Show compliance with requirements.
- G. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

#### 1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Resolution of Compatibility Disputes between Multiple Contractors:
    - a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
    - b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used.

- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
  - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
  - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
    - a. Name of product and manufacturer.
    - b. Model and serial number.
    - c. Capacity.
    - d. Speed.
    - e. Ratings.
  - 3. See individual identification Sections in Divisions 22, 23, and 26 for additional equipment identification requirements.

## 1.5 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.
- C. Storage:
  - 1. Store products to allow for inspection and measurement of quantity or counting of units.
  - 2. Store materials in a manner that will not endanger Project structure.

3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection for wind.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
  1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
  3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01770 "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.



2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Engineer will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
  - a. Submit additional documentation required by Engineer in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Engineer, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product that complies with requirements.
  - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
  - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer that complies with requirements.
  - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
  - a. For approval of products by unnamed manufacturers, comply with requirements in Section 01250 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Engineer's sample," provide a product that complies with requirements and matches Engineer's sample. Engineer's decision will be final on whether a proposed product matches.
  1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01250 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Engineer from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.
  1. Select products for which sustainable design documentation submittals are available from manufacturer.

## 2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance the following requirements:
1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects, with project names and addresses and names and addresses of Engineers and owners, if requested.
  5. Samples, if requested.
- B. Engineer's Action on Comparable Products Submittal: If necessary, Engineer will request additional information or documentation for evaluation, as specified in Section 01330 "Submittal Procedures."
1. Form of Approval of Submittal: As specified in Section 01330 "Submittal Procedures."
  2. Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by the Engineer of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to Engineer, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Engineer of Contractor' request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

## PART 3 - EXECUTION (NOT USED)

END OF SECTION 01600

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## SECTION 01730 - EXECUTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

- 1. Installation of the Work.
- 2. Cutting and patching.
- 3. Coordination of Owner-installed products.
- 4. Progress cleaning.
- 5. Starting and adjusting.
- 6. Protection of installed construction.

- B. Related Requirements:

- 1. Section 01110 "Summary" for limits on use of Project site.
- 2. Section 01330 "Submittal Procedures" for submitting surveys.
- 3. Section 01770 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

#### 1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

#### 1.4 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  - 1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements, whose structural function is not known, notify Engineer of locations and details of cutting and await directions from

- Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    - a. Primary operational systems and equipment.
    - b. Fire separation assemblies.
    - c. Air or smoke barriers.
    - d. Fire-suppression systems.
    - e. Plumbing piping systems.
    - f. Mechanical systems piping and ducts.
    - g. Control systems.
    - h. Communication systems.
    - i. Fire-detection and -alarm systems.
    - j. Conveying systems.
    - k. Electrical wiring systems.
    - l. Operating systems of special construction.
  3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
    - a. Water, moisture, or vapor barriers.
    - b. Membranes and flashings.
    - c. Exterior curtain-wall construction.
    - d. Sprayed fire-resistive material.
    - e. Equipment supports.
    - f. Piping, ductwork, vessels, and equipment.
    - g. Noise- and vibration-control elements and systems.
  4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Comply with requirements specified in other Sections.

- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
  - 1. Description of the Work.
  - 2. List of detrimental conditions, including substrates.
  - 3. List of unacceptable installation tolerances.
  - 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Engineer in accordance to requirements in Section 01310 "Project Management and Coordination."

### 3.3 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
  - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Engineer. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items onsite and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with



other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
  2. Allow for building movement, including thermal expansion and contraction.
  3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Engineer. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
1. Comply with Section 01770 "Closeout Procedures" for repairing or removing and replacing defective Work.

### 3.4 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 01110 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or

adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering, and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Engineer. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.5 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
  - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  - 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences, covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### 3.6 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  - 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- I. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 01400 "Quality Requirements."

### 3.8 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01730

## SECTION 01740 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging nonhazardous demolition and construction waste.
  - 2. Recycling nonhazardous demolition and construction waste.
  - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
  - 1. Section 02200 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

#### 1.3 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

#### 1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste shall become property of Contractor.

#### 1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:
  - 1. Material category.
  - 2. Generation point of waste.
  - 3. Total quantity of waste in tons.
  - 4. Quantity of waste salvaged, both estimated and actual in tons.
  - 5. Quantity of waste recycled, both estimated and actual in tons.
  - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
  - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Qualification Data: For waste management coordinator.
- H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

## 1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements.
- B. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conferences: Conduct conferences at Project site to comply with requirements in Section 01310 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
  - 1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
  - 2. Review requirements for documenting quantities of each type of waste and its disposition.
  - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  - 5. Review waste management requirements for each trade.

## 1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work in compliance with Section 02222 "Selective Demolition."
  - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:
1. Total quantity of waste.
  2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
  3. Total cost of disposal (with no waste management).
  4. Revenue from salvaged materials.
  5. Revenue from recycled materials.
  6. Savings in transportation and tipping fees by donating materials.
  7. Savings in transportation and tipping fees that are avoided.
  8. Handling and transportation costs. Include cost of collection containers for each type of waste.
  9. Net additional cost or net savings from waste management plan.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:
1. Demolition Waste:
    - a. Asphalt paving.
    - b. Concrete.
    - c. Concrete reinforcing steel.
    - d. Brick.
    - e. Concrete masonry units.
    - f. Wood studs.
    - g. Wood joists.
    - h. Plywood and oriented strand board.
    - i. Wood paneling.
    - j. Wood trim.
    - k. Structural and miscellaneous steel.
    - l. Rough hardware.
    - m. Roofing.
    - n. Insulation.
    - o. Doors and frames.
    - p. Door hardware.



- q. Windows.
- r. Glazing.
- s. Metal studs.
- t. Gypsum board.
- u. Acoustical tile and panels.
- v. Carpet.
- w. Carpet pad.
- x. Demountable partitions.
- y. Equipment.
- z. Cabinets.
- aa. Plumbing fixtures.
- bb. Piping.
- cc. Supports and hangers.
- dd. Valves.
- ee. Sprinklers.
- ff. Mechanical equipment.
- gg. Refrigerants.
- hh. Electrical conduit.
- ii. Copper wiring.
- jj. Lighting fixtures.
- kk. Lamps.
- ll. Ballasts.
- mm. Electrical devices.
- nn. Switchgear and panelboards.
- oo. Transformers.

2. Construction Waste:

- a. Masonry and CMU.
- b. Lumber.
- c. Wood sheet materials.
- d. Wood trim.
- e. Metals.
- f. Roofing.
- g. Insulation.
- h. Carpet and pad.
- i. Gypsum board.
- j. Piping.
- k. Electrical conduit.
- l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
  - 1) Paper.
  - 2) Cardboard.
  - 3) Boxes.
  - 4) Plastic sheet and film.
  - 5) Polystyrene packaging.
  - 6) Wood crates.
  - 7) Wood pallets.
  - 8) Plastic pails.

- m. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
  - 1) Paper.
  - 2) Aluminum cans.
  - 3) Glass containers.

## PART 3 - EXECUTION

### 3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  - 1. Comply with operation, termination, and removal requirements in Section 01500 "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
  - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
  - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
  - 2. Comply with Section 01500 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- E. Waste Management in Historic Zones or Areas: Transportation equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 12 inches or more.

### 3.2 SALVAGING DEMOLITION WASTE

- A. Comply with requirements in Section 02222 "Selective Demolition" for salvaging demolition waste.

- B. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  - 3. Store items in a secure area until installation.
  - 4. Protect items from damage during transport and storage.
  - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- C. Salvaged Items for Sale and Donation: Not permitted on Project site.
- D. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  - 3. Store items in a secure area until delivery to Owner.
  - 4. Transport items to Owner's storage area designated by Owner.
  - 5. Protect items from damage during transport and storage.
- E. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- F. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- G. Plumbing Fixtures: Separate by type and size.
- H. Lighting Fixtures: Separate lamps by type and protect from breakage.
- I. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

### 3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
  - a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

### 3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.
  1. Crush asphaltic concrete paving and screen to comply with requirements in Section 02300 "Earthwork" for use as general fill.
- B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
  1. Pulverize concrete to maximum 1-1/2-inch size.
  2. Crush concrete and screen to comply with requirements in Section 02300 "Earthwork" for use as satisfactory soil for fill or subbase.
- D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
  1. Pulverize masonry to maximum 3/4-inch size.
    - a. Crush masonry and screen to comply with requirements in Section 02300 "Earthwork" for use as general fill satisfactory soil for fill or subbase.
    - b. Crush masonry and screen to comply with requirements in Section 02930 "Plants" for use as mineral mulch.
  2. Clean and stack undamaged, whole masonry units on wood pallets.
- E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- F. Metals: Separate metals by type.
  1. Structural Steel: Stack members according to size, type of member, and length.
  2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

- G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- J. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.
- K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
  - 1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- L. Carpet Tile: Remove debris, trash, and adhesive.
  - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- M. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.
- N. Conduit: Reduce conduit to straight lengths and store by material and size.
- O. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

### 3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
    - a. Comply with requirements in Section 02930 "Plants" for use of clean sawdust as organic mulch.

- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
  - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
    - a. Comply with requirements in Section 02930 "Plants" for use of clean ground gypsum board as inorganic soil amendment.
- D. Paint: Seal containers and store by type.

### 3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.
- C. Burning: Do not burn waste materials.

### 3.7 ATTACHMENTS

- A. Form CWM-1 for construction waste identification.
- B. Form CWM-2 for demolition waste identification.
- C. Form CWM-3 for construction waste reduction work plan.
- D. Form CWM-4 for demolition waste reduction work plan.
- E. Form CWM-5 for cost/revenue analysis of construction waste reduction work plan.
- F. Form CWM-6 for cost/revenue analysis of demolition waste reduction work plan.
- G. Form CWM-7 for construction waste reduction progress report.
- H. Form CWM-8 for demolition waste reduction progress report.

END OF SECTION 01740

## SECTION 01770 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.
- B. Related Requirements:
  - 1. Section 01782 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
  - 2. Section 01783 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

## 1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
  - 2. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 3. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Engineer. Label with manufacturer's name and model number.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Engineer's signature for receipt of submittals.
  - 4. Submit testing, adjusting, and balancing records.
  - 5. Submit sustainable design submittals not previously submitted.
  - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Advise Owner of pending insurance changeover requirements.
  - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  - 3. Complete startup and testing of systems and equipment.
  - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
  - 6. Advise Owner of changeover in utility services.
  - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.



8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements.
  10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for Final Completion.

#### 1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Section 01290 "Payment Procedures."
  2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report.
  5. Submit Final Completion photographic documentation.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.8 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
  - a. Project name.
  - b. Date.
  - c. Name of Engineer.
  - d. Name of Contractor.
  - e. Page number.
4. Submit list of incomplete items in the following format:
  - a. MS Excel Electronic File. Engineer will return annotated file.

#### 1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
  1. Submit by uploading to web-based project software site.
- E. Warranties in Paper Form:
  1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
  - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake disturbed grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - g. Sweep concrete floors broom clean in unoccupied spaces.
    - h. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - i. Remove labels that are not permanent.

- j. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - k. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - l. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - m. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01500 "Temporary Facilities and Controls."

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 01730 "Execution" before requesting inspection for determination of Substantial Completion.
- B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
  - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01770

## SECTION 01782 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory manuals.
  - 2. Emergency manuals.
  - 3. Systems and equipment operation manuals.
  - 4. Systems and equipment maintenance manuals.
  - 5. Product maintenance manuals.
- B. Related Requirements:
  - 1. Section 01330 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

#### 1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Engineer will comment on whether content of operation and maintenance submittals is acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operation and maintenance manuals in the following format:
  - 1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Engineer will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 7 days before commencing demonstration and training. Engineer will return copy with comments.
  - 1. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's comments and prior to commencing demonstration and training.
- E. Comply with Section 01770 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

#### 1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
  - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
  - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
  - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

#### 1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  1. Title page.
  2. Table of contents.
  3. Manual contents.
- B. Title Page: Include the following information:
  1. Subject matter included in manual.
  2. Name and address of Project.
  3. Name and address of Owner.
  4. Date of submittal.
  5. Name and contact information for Contractor.
  6. Name and contact information for Construction Manager.
  7. Name and contact information for Engineer.
  8. Name and contact information for Commissioning Authority.
  9. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
  10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
  1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

## 1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
  - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
  - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
  - 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

## 1.8 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
  - 1. Type of emergency.
  - 2. Emergency instructions.
  - 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
  - 1. Fire.
  - 2. Flood.
  - 3. Gas leak.
  - 4. Water leak.
  - 5. Power failure.
  - 6. Water outage.
  - 7. System, subsystem, or equipment failure.
  - 8. Chemical release or spill.



- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
  - 1. Instructions on stopping.
  - 2. Shutdown instructions for each type of emergency.
  - 3. Operating instructions for conditions outside normal operating limits.
  - 4. Required sequences for electric or electronic systems.
  - 5. Special operating instructions and procedures.

## 1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  - 2. Performance and design criteria if Contractor has delegated design responsibility.
  - 3. Operating standards.
  - 4. Operating procedures.
  - 5. Operating logs.
  - 6. Wiring diagrams.
  - 7. Control diagrams.
  - 8. Piped system diagrams.
  - 9. Precautions against improper use.
  - 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
  - 1. Product name and model number. Use designations for products indicated on Contract Documents.
  - 2. Manufacturer's name.
  - 3. Equipment identification with serial number of each component.
  - 4. Equipment function.
  - 5. Operating characteristics.
  - 6. Limiting conditions.
  - 7. Performance curves.
  - 8. Engineering data and tests.

9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
  2. Equipment or system break-in procedures.
  3. Routine and normal operating instructions.
  4. Regulation and control procedures.
  5. Instructions on stopping.
  6. Normal shutdown instructions.
  7. Seasonal and weekend operating instructions.
  8. Required sequences for electric or electronic systems.
  9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

#### 1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format,

identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

- a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
  2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  3. Identification and nomenclature of parts and components.
  4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
  2. Troubleshooting guide.
  3. Precautions against improper maintenance.
  4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  5. Aligning, adjusting, and checking instructions.
  6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.

## 1.11 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Color, pattern, and texture.
  - 4. Material and chemical composition.
  - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.
  - 3. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01782

## SECTION 01783 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Section 01290 "Payment Procedures" for maintaining and exhibiting project record documents as a prerequisite for progress payments.
  - 2. Section 01730 "Execution" for final property survey.
  - 3. Section 01770 "Closeout Procedures" for general closeout procedures.
  - 4. Section 01782 "Operation and Maintenance Data" for operation and maintenance manual requirements.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set(s) of marked-up record prints.
  - 2. Number of Copies: Submit copies of Record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
      - 2) Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    - b. Final Submittal:
      - 1) Submit PDF electronic files of scanned Record Prints and 2 set(s) of file prints.

- 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

#### 1.4 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross-reference record prints to corresponding photographic documentation.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Work Change Directive.
    - k. Changes made following Engineer's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
  3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as for the original Contract Drawings.
  2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  3. Refer instances of uncertainty to Engineer for resolution.
  4. Engineer will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
    - a. See Section 01310 "Project Management and Coordination" for requirements related to use of Engineer's digital data files.
    - b. Engineer will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Engineer.
    - e. Name of Contractor.

## 1.5 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders and Record Drawings where applicable.
- C. Format: Submit Record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

#### 1.6 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

#### 1.7 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours. As a prerequisite for monthly progress payments, exhibit the updated record documents for review by Owner and Engineer for accuracy and completeness.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01783



## SECTION 01790 - DEMONSTRATION AND TRAINING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
  - 2. Demonstration and training video recordings.
- B. Unit Price for Instruction Time: Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up. See requirements in Section 01220 "Unit Prices."

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
  - 1. Identification: On each copy, provide an applied label with the following information:
    - a. Name of Project.

- b. Name and address of videographer.
- c. Name of Engineer.
- d. Name of Construction Manager.
- e. Name of Contractor.
- f. Date of video recording.

## 1.5 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01400 "Quality Requirements," experienced in operation and maintenance procedures and training.

## 1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Engineer.

## 1.7 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  - 2. Documentation: Review the following items in detail:
    - a. Emergency manuals.

- b. Systems and equipment operation manuals.
  - c. Systems and equipment maintenance manuals.
  - d. Product maintenance manuals.
  - e. Project Record Documents.
  - f. Identification systems.
  - g. Warranties and bonds.
  - h. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
  - a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
  - a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning.

- e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## 1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01782 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

## 1.9 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Owner will furnish an instructor to describe Owner's operational philosophy, if applicable.
  - 2. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner with at least seven days' advance notice.
- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use, as appropriate.

## 1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. A manufacturer's representative with experience recording instructional videos may serve as videographer if representative video footage is provided and approved by Owner and/or Engineer. Record each training module separately. Include classroom

instructions and demonstrations, board diagrams, and other visual aids, as appropriate, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
1. Submit video recordings on CD-ROM or thumb drive.
  2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents.
  3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
  4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
    - a. Name of Contractor/Installer.
    - b. Business address.
    - c. Business phone number.
    - d. Point of contact.
    - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
1. Film training session(s) in segments not to exceed 15 minutes.
    - a. Produce segments to present a single significant piece of equipment per segment.
    - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video is being recorded or dubbing audio narration off-site after video is recorded. Include description of items being viewed.
- F. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01790

## SECTION 01910 - GENERAL COMMISSIONING REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Owner's Project Requirements and Basis-of-Design Document are included by reference for information only.

#### 1.2 SUMMARY

A. Section Includes:

- 1. General requirements for coordinating and scheduling commissioning activities.
- 2. Commissioning meetings.
- 3. Commissioning reports.
- 4. Use of commissioning process test equipment, instrumentation, and tools.
- 5. Construction checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
- 6. Commissioning tests and commissioning test demonstration.
- 7. Adjusting, verifying, and documenting identified systems and assemblies.

B. Related Requirements:

- 1. Section 01110 "Summary" for Commissioning Authority responsibilities.
- 2. Section 01330 "Submittal Procedures" for submittal procedure requirements for commissioning process.
- 3. Section 01770 "Closeout Procedures" for Certificate of Construction-Phase Commissioning Process Completion submittal requirements.
- 4. Section 01782 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal requirements.

#### 1.3 ALLOWANCES

A. Labor and management costs for the performance of commissioning process.

B. The following are excluded from the commissioning allowance:

- 1. Equipment and systems installation, startup, and field quality-control testing indicated in the Contract Documents.
- 2. Test equipment, instrumentation, and tools (including, but not limited to, proprietary test equipment, instrumentation, and tools) required to perform tests.
- 3. Work to correct commissioning issues.
- 4. Work to repeat tests when equipment and systems fail acceptance criteria.

#### 1.4 UNIT PRICES

- A. Commissioning allowance may be adjusted up or down by the "List of Unit Prices" Article in Section 01220 "Unit Prices" when actual labor hours are computed at the end of commissioning process. See Section 01210 "Allowances" for commissioning allowance.
- B. The following are excluded from the computation for the adjustment of the commissioning allowance for technician labor hours:
  - 1. Work to correct commissioning issues.
  - 2. Work to repeat tests when equipment and systems fail acceptance criteria.

#### 1.5 DEFINITIONS

- A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.
- B. Basis-of-Design Document: A document prepared by Engineer that records concepts, calculations, decisions, and product selections used to comply with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.
- C. Commissioning Authority: An entity engaged by Owner and identified in Section 01110 "Summary," to evaluate Commissioning-Process Work.
- D. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation of commissioning requirements.
- E. Commissioning: A quality-focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. The requirements specified here are limited to the construction phase commissioning activities. The scope of the commissioning process is defined in Section 01110 "Summary."
- F. Construction-Phase Commissioning-Process Completion: The stage of completion and acceptance of commissioning process when resolution of deficient conditions and issues discovered during commissioning process and retesting until acceptable results are obtained has been accomplished. Owner will establish in writing the date construction-phase commissioning-process completion is achieved. See Section 01770 "Closeout Procedures" for Certificate of Construction-Phase Commissioning Process Completion submittal requirements.
  - 1. Commissioning process is complete when the Work specified of this Section and related Sections has been completed and accepted, including, but not limited to, the following:
    - a. Completion of tests and acceptance of test results.
    - b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
    - c. Comply with requirements in Section 01790 "Demonstration and Training."
    - d. Completion and acceptance of submittals and reports.



- G. Owner's Project Requirements: A document that details the functional requirements of a project and the expectations of how it will be used and operated, including Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. This document is prepared either by the Owner or for the Owner by the Engineer or Commissioning Authority.
- H. Owner's Witness: Commissioning Authority, Owner's Project Manager, or Engineer-designated witness authorized to authenticate test demonstration data and to sign completed test data forms.
- I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.
- J. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.
- K. Sampling Procedures and Tables for Inspection by Attributes: As defined in ASQ Z1.4.

## 1.6 COMPENSATION

- A. If Engineer, Commissioning Authority, other Owner's witness, or Owner's staff perform additional services or incur additional expenses due to actions of Contractor listed below, compensate Owner for such additional services and expenses.
  - 1. Failure to provide timely notice of commissioning activities schedule changes.
  - 2. Failure to meet acceptance criteria for test demonstrations.

## 1.7 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s):
  - 1. Commissioning Coordinator: A person or entity employed by Contractor to manage, schedule, and coordinate commissioning process.
  - 2. Project superintendent and other employees that Contractor may deem appropriate for a particular portion of the commissioning process.
  - 3. Subcontractors, installers, suppliers, and specialists that Contractor may deem appropriate for a particular portion of the commissioning process.
  - 4. Appointed team members shall have the authority to act on behalf of the entity they represent.
- B. Members Appointed by Owner:
  - 1. Commissioning Authority, plus consultants that Commissioning Authority may deem appropriate for a particular portion of the commissioning process.
  - 2. Owner representative(s), facility operations and maintenance personnel, plus other employees, separate contractors, and consultants that Owner may deem appropriate for a particular portion of the commissioning process.
  - 3. Engineer, plus employees and consultants that Engineer may deem appropriate for a particular portion of the commissioning process.

## 1.8 INFORMATIONAL SUBMITTALS

- A. Comply with requirements in Section 01330 "Submittal Procedures" for submittal procedure general requirements for commissioning process.
- B. Commissioning Plan Information:
  - 1. List of Contractor-appointed commissioning team members to include specific personnel and subcontractors performing the various commissioning requirements.
  - 2. Schedule of commissioning activities, integrated with the Construction Schedule. Comply with requirements in Section 01320 "Construction Progress Documentation" for the Construction Schedule general requirements for commissioning process.
  - 3. Contractor personnel and subcontractors participating in each test.
  - 4. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.
- C. Commissioning schedule.
- D. Two-week look-ahead schedules.
- E. Commissioning Coordinator Letter of Authority:
  - 1. Within 10 days after approval of Commissioning Coordinator qualifications, submit a letter of authority for Commissioning Coordinator, signed by a principal of Contractor's firm. Letter shall authorize Commissioning Coordinator to do the following:
    - a. Make inspections required for commissioning process.
    - b. Coordinate, schedule, and manage commissioning process of Contractor, subcontractors, and suppliers.
    - c. Obtain documentation required for commissioning process from Contractor, subcontractors, and suppliers.
    - d. Report issues, delayed resolution of issues, schedule conflicts, and lack of cooperation or expertise on the part of members of the commissioning team.
- F. Commissioning Coordinator Qualification Data: For entity coordinating Contractor's commissioning activities to demonstrate their capabilities and experience.
  - 1. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- G. List test instrumentation, equipment, and monitoring devices. Include the following information:
  - 1. Make, model, serial number, and application for each instrument, equipment, and monitoring device.
  - 2. Brief description of intended use.
  - 3. Calibration record showing the following:
    - a. Calibration agency, including name and contact information.

- b. Last date of calibration.
- c. Range of values for which calibration is valid.
- d. Certification of accuracy.
- e. Certification for calibration equipment traceable to NIST.
- f. Due date of the next calibration.

H. Test Reports:

1. Pre-Startup Report: Prior to startup of equipment or a system, submit signed, completed construction checklists.
2. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.
3. Commissioning Issue Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.
4. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.
5. Data Trend Logs: Submit data trend logs at the end of the trend log period.
6. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit printout of log of alarms that occurred since the last log was printed.

I. Construction Checklists:

1. Material checks.
2. Installation checks.
3. Startup procedures, where required.

1.9 CLOSEOUT SUBMITTALS

A. Commissioning Report:

1. At Construction-Phase Commissioning Completion, include the following:
  - a. Pre-startup reports.
  - b. Approved test procedures.
  - c. Test data forms, completed and signed.
  - d. Progress reports.
  - e. Commissioning issue report log.
  - f. Commissioning issue reports showing resolution of issues.
  - g. Correspondence or other documents related to resolution of issues.
  - h. Other reports required by commissioning process.
  - i. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction-Phase Commissioning Completion.
  - j. Report shall include commissioning work of Contractor.

B. Request for Certificate of Construction-Phase Commissioning Process Completion.

C. Operation and Maintenance Data: For proprietary test equipment, instrumentation, and tools to include in operation and maintenance manuals.

## 1.10 QUALITY ASSURANCE

### A. Commissioning Coordinator Qualifications:

1. Documented experience commissioning systems of similar complexity to those contained in these documents on at least three projects of similar scope and complexity.
2. Certification of commissioning-process expertise. The following certifications are acceptable. Owner reserves the right to accept or reject certifications as evidence of qualification.
  - a. Certified Commissioning Authority, by AABC Commissioning Group (ACG).
  - b. Commissioning-Process Management Professional, by American Society of Heating, Refrigerating and Air-Conditioning Engineers.
  - c. Certified Commissioning Professional, by Building Commissioning Association.
  - d. Accredited Commissioning-Process Authority Professional, by University of Wisconsin.
  - e. Accredited Commissioning-Process Manager, by University of Wisconsin.
  - f. Accredited Green Commissioning-Process Provider, by University of Wisconsin.

B. Calibration Agency Qualifications: Certified by The American Association for Laboratory Accreditation that the calibration agency complies with minimum requirements of ISO/IEC 17025.

C. Contractor Agency Qualifications: Certified by The American Association of Laboratory Accreditation that the calibration agency complies with minimum requirements of ISO/IEC 17025.

## PART 2 - PRODUCTS

### 2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

- A. Test equipment and instrumentation required to perform the commissioning process shall remain the property of Contractor unless otherwise indicated.
- B. Test equipment and instrumentation required to perform commissioning process shall comply with the following criteria:
  1. Be manufactured for the purpose of testing and measuring tests for which they are being used and have an accuracy to test and measure system performance within the tolerances required to determine acceptable performance.
  2. Calibrated and certified.
    - a. Calibration performed and documented by a qualified calibration agency according to national standards applicable to the tools and instrumentation being calibrated. Calibration shall be current according to national standards or within test equipment and instrumentation manufacturer's recommended intervals, whichever is more frequent, but not less than within six months of initial use on Project. Calibration tags shall be permanently affixed.

- b. Repair and recalibrate test equipment and instrumentation if dismantled, dropped, or damaged since last calibrated.
3. Maintain test equipment and instrumentation.
4. Use test equipment and instrumentation only for testing or monitoring Work for which they are designed.

## 2.2 PROPRIETARY TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

- A. Proprietary test equipment, instrumentation, and tools are those manufactured or prescribed by tested equipment manufacturer and required for work on its equipment as a condition of equipment warranty, or as otherwise required to service, repair, adjust, calibrate, or perform work on its equipment.
  1. Identify proprietary test equipment, instrumentation, and tools required in the test equipment identification list submittal.
  2. Proprietary test equipment, instrumentation, and tools shall become the property of Owner at Substantial Completion.

## 2.3 REPORT FORMAT AND ORGANIZATION

- A. General Format and Organization:
  1. Bind report in three-ring binders.
  2. Label the front cover and spine of each binder with the report title, volume number, project name, Contractor's name, and date of report.
  3. Record report on compact disk.
  4. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.
- B. Commissioning Report:
  1. Include a table of contents and an index to each test.
  2. Include major tabs for each Specification Section.
  3. Include minor tabs for each test.
  4. Within each minor tab, include the following:
    - a. Test specification.
    - b. Pre-startup reports.
    - c. Approved test procedures.
    - d. Test data forms, completed and signed.
    - e. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within the minor tab, in reverse chronological order (most recent on top).

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Review preliminary construction checklists and preliminary test procedures and data forms.

### 3.2 CONSTRUCTION CHECKLISTS

- A. Construction checklists cannot modify or conflict with the Contract Documents.
- B. Create construction checklists based on actual systems and equipment to be included in Project.
- C. Material Checks: Compare specified characteristics and approved submittals with materials as received. Include factory tests and other evaluations, adjustments, and tests performed prior to shipment if applicable.
  - 1. Service connection requirements, including configuration, size, location, and other pertinent characteristics.
  - 2. Included optional features.
  - 3. Delivery Receipt Check: Inspect and record physical condition of materials and equipment on delivery to Project site, including agreement with approved submittals, cleanliness, and lack of damage.
  - 4. Installation Checks:
    - a. Location according to Drawings and approved Shop Drawings.
    - b. Configuration.
    - c. Compliance with manufacturers' written installation instructions.
    - d. Attachment to structure.
    - e. Access clearance to allow for maintenance, service, repair, removal, and replacement without the need to disassemble or remove other equipment or building elements. Access coordinated with other building elements and equipment, including, but not limited to, ceiling and wall access panels, in a manner consistent with OSHA fall-protection regulations and safe work practices.
    - f. Utility connections are of the correct characteristics, as applicable.
    - g. Correct labeling and identification.
    - h. Startup Checks: Verify readiness of equipment to be energized. Include manufacturer's standard startup procedures and forms.
- D. Startup: Perform and document initial operation of equipment to prove that it is installed properly and operates as intended according to manufacturer's standard startup procedures, at minimum.
- E. Performance Tests:
  - 1. Static Tests: As specified elsewhere, including, but not limited to, duct and pipe leakage tests, insulation-resistance tests, and water-penetration tests.
  - 2. Component Performance Tests: Tests evaluate the performance of an input or output of components under a full range of operating conditions.

3. Equipment and Assembly Performance Tests: Test and evaluate performance of equipment and assemblies under a full range of operating conditions and loads.
  4. System Performance Tests: Test and evaluate performance of systems under a full range of operating conditions and loads.
  5. Intersystem Performance Tests: Test and evaluate the interface of different systems under a full range of operating conditions and loads.
- F. Deferred Construction Checklists: Obtain Owner approval of proposed deferral of construction checklists, including proposed schedule of completion of each deferred construction checklist, before submitting request for Certificate of Construction-Phase Commissioning Process Completion. When approved, deferred construction checklists may be completed after date of Construction-Phase Commissioning Completion. Include the following in a request for Certificate of Construction-Phase Commissioning Process Completion:
1. Identify deferred construction checklists by number and title.
  2. Provide a target schedule for completion of deferred construction checklists.
  3. Written approval of proposed deferred construction checklists, including approved schedule of completion of each deferred construction checklist.
- G. Delayed Construction Checklists: Obtain Owner approval of proposed delayed construction checklists, including proposed schedule of completion of each delayed construction checklist, before submitting request for Certificate of Construction-Phase Commissioning Process Completion. When approved, delayed construction checklists may be completed after date of Construction-Phase Commissioning Completion. Include the following in a request for Certificate of Construction-Phase Commissioning Process Completion:
1. Identify delayed construction checklist by construction checklist number and title.
  2. Provide a target schedule for completion of delayed construction checklists.
  3. Written approval of proposed delayed construction checklists, including approved schedule of completion of each delayed construction checklist.

### 3.3 GENERAL EXECUTION REQUIREMENTS

- A. Schedule and coordinate commissioning process with the Construction Schedule.
- B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.
- C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies. In some instances, demonstration of a random sample of other than 100 percent of the results of a test is specified.
  1. Where sampling is specified, the sampling plan and procedure for the test demonstration shall be determined using ASQ Z1.4.
    - a. General Inspection: Level I.
    - b. Special Inspection: Level S-1.
    - c. Acceptance Quality Limit (AQL) of 1.5.

2. The "lot size" in ASQ Z1.4 is the sum of the number of items to which the test demonstration applies, as described in the scope subparagraph of each test.
  3. On determination of the sample size, the samples shall be selected randomly by Owner's witness at the time of the test demonstration.
  4. Include in the Commissioning Plan a detailed list of the test demonstrations with lot and sample quantities for each test.
- D. Report test data and commissioning issue resolutions.
- E. Schedule personnel to participate in and perform Commissioning-Process Work.
- F. Installing contractors' commissioning responsibilities include, but are not limited to, the following:
1. Operating the equipment and systems they install during tests.
  2. In addition, installing contractors may be required to assist in tests of equipment and systems with which their work interfaces.

### 3.4 COMMISSIONING COORDINATOR RESPONSIBILITIES

- A. Management and Coordination: Manage, schedule, and coordinate commissioning process, including, but not limited to, the following:
1. Coordinate with subcontractors on their commissioning responsibilities and activities.
  2. Obtain, assemble, and submit commissioning documentation.
  3. Conduct periodic on-site commissioning meetings. Comply with requirements in Section 01310 "Project Management and Coordination."
  4. Develop and maintain the commissioning schedule. Integrate commissioning schedule into the Construction Schedule. Update Construction Schedule at specified intervals.
  5. Review and comment on preliminary test procedures and data forms.
  6. Report inconsistencies and issues in system operations.
  7. Verify that tests have been completed and results comply with acceptance criteria, and that equipment and systems are ready before scheduling test demonstrations.
  8. Direct and coordinate test demonstrations.
  9. Coordinate witnessing of test demonstrations by Owner's witness.
  10. Coordinate and manage training. Be present during training sessions to direct video recording, present training, and direct the training presentations of others. Comply with requirements in Section 01790 "Demonstration and Training."
  11. Prepare and submit specified commissioning reports.
  12. Track commissioning issues until resolution and retesting is successfully completed.
  13. Retain original records of Commissioning-Process Work, organized as required for the commissioning report. Provide Owner's representative access to these records on request.
  14. Assemble and submit commissioning report.

### 3.5 COMMISSIONING TESTING

- A. Quality Control: Construction checklists, including tests, are quality-control tools designed to improve the functional quality of Project. Test demonstrations evaluate the effectiveness of Contractor's quality-control process.



- B. Owner's witness will be present to witness commissioning work requiring the signature of an owner's witness, including, but not limited to, test demonstrations. Owner's project manager will coordinate attendance by Owner's witness with Contractor's published Commissioning Schedule. Owner's witness will provide no labor or materials in the commissioning work. The only function of Owner's witness will be to observe and comment on the progress and results of commissioning process.
- C. Construction Checklists:
  - 1. Complete construction checklists as Work is completed.
  - 2. Distribute construction checklists to installing contractors before they start work.
  - 3. Installers:
    - a. Verify installation using approved construction checklists as Work proceeds.
    - b. Complete and sign construction checklists daily for work performed during the preceding day.
  - 4. Provide Commissioning Authority access to construction checklists.
- D. Installation Compliance Issues: Record as an installation compliance issue Work found to be incomplete, inaccessible, at variance with the Contract Documents, nonfunctional, or that does not comply with construction checklists. Record installation compliance issues on the construction checklist at the time they are identified. Record corrective action and how future Work should be modified before signing off the construction checklist.
- E. Pre-Startup Audit: Prior to executing startup procedures, review completed installation checks to determine readiness for startup and operation. Report conditions, which, if left uncorrected, adversely impact the ability of systems or equipment to operate satisfactorily or to comply with acceptance criteria. Prepare pre-startup report for each system.
- F. Test Procedures and Test Data Forms:
  - 1. Test procedures shall define the step-by-step procedures to be used to execute tests and test demonstrations.
  - 2. Test procedures shall be specific to the make, model, and application of the equipment and systems being tested.
  - 3. Completed test data forms are the official records of the test results.
  - 4. Commissioning Authority will provide to Contractor preliminary test procedures and test data forms for performance tests and commissioning tests after approval of Product Data, Shop Drawings, and preliminary operation and maintenance manual.
  - 5. Review preliminary test procedures and test data forms, and provide comments within 14 days of receipt from Commissioning Authority. Review shall address the following:
    - a. Equipment protection and warranty issues, including, but not limited to, manufacturers' installation and startup recommendations, and operation and maintenance instructions.
    - b. Applicability of the procedure to the specific software, equipment, and systems approved for installation.

6. After Contractor has reviewed and commented on the preliminary test procedures and test data forms, Commissioning Authority will revise and reissue the approved revised test procedures and test data forms marked "Approved for Testing."
7. Use only approved test procedures and test data forms marked "Approved for Testing" to perform and document tests and test demonstrations.

G. Performance of Tests:

1. The sampling rate for tests is 100 percent. The sampling rate for test demonstrations is 100 percent unless otherwise indicated.
2. Perform and complete each step of the approved test procedures in the order listed.
3. Record data observed during performance of tests on approved data forms at the time of test performance and when the results are observed.
4. Record test results that are not within the range of acceptable results on commissioning issue report forms in addition to recording the results on approved test procedures and data forms according to the "Commissioning Compliance Issues" Paragraph in this Article.
5. On completion of a test, sign the completed test procedure and data form. Tests for which test procedures and data forms are incomplete, not signed, or which indicate performance that does not comply with acceptance criteria will be rejected. Tests for which test procedures and data forms are rejected shall be repeated and results resubmitted.

H. Performance of Test Demonstration:

1. Perform test demonstrations on a sample of tests after test data submittals are approved. The sampling rate for test demonstrations shall be 100 percent unless otherwise indicated in the individual test specification.
2. Notify Owner's witness at least three days in advance of each test demonstration.
3. Perform and complete each step of the approved test procedures in the order listed.
4. Record data observed during performance of test demonstrations on approved data forms at the time of demonstration and when the results are observed.
5. Provide full access to Owner's witness to directly observe the performance of all aspects of system response during the test demonstration. On completion of a test demonstration, sign the completed data form and obtain signature of Owner's witness at the time of the test to authenticate the reported results.
6. Test demonstration data forms not signed by Contractor and Owner's witness at the time of the completion of the procedure will be rejected. Test demonstrations for which data forms are rejected shall be repeated and results shall be resubmitted.
  - a. Exception for Failure of Owner's Witness to Attend: Failure of Owner's witness to be present for agreed-on schedule of test demonstration shall not delay Contractor. If Owner's witness fails to attend a scheduled test, Contractor shall proceed with the scheduled test. On completion, Contractor shall sign the data form for Contractor and for Owner's witness and shall note the absence of Owner's witness at the scheduled time and place.
7. False load test requirements are specified in related sections.
  - a. Where false load testing is specified, provide temporary equipment, power, controls, wiring, piping, valves, and other necessary equipment and connections required to apply the specified load to the system. False load system shall be

capable of steady-state operation and modulation at the level of load specified. Equipment and systems permanently installed in this work shall not be used to create the false load without Engineer's written approval.

I. Deferred Tests:

1. Deferred Test List: Identify, in the request for Certificate of Construction-Phase Commissioning Process Completion, proposed deferred tests or other tests approved for deferral until specified seasonal or other conditions are available. When approved, deferred tests may be completed after the date of Construction-Phase Commissioning Completion. Identify proposed deferred tests in the request for Certificate of Construction-Phase Commissioning Process Completion as follows:
  - a. Identify deferred tests by number and title.
  - b. Provide a target schedule for completion of deferred tests.
2. Schedule and coordinate deferred tests. Schedule deferred tests when specified conditions are available. Notify Engineer and Commissioning Authority at least three working days (minimum) in advance of tests.
3. Where deferred tests are specified, coordinate participation of necessary personnel and of Engineer, Commissioning Authority, and Owner's witness. Schedule deferred tests to minimize occupant and facility impact. Obtain Engineer's approval of the proposed schedule.

J. Delayed Tests:

1. Delayed Test List: Identify, in the request for Certificate of Construction-Phase Commissioning Process Completion, proposed delayed tests. Obtain Owner approval of proposed delayed tests, including proposed schedule of completion of each delayed test, before submitting request for Certificate of Construction-Phase Commissioning Process Completion. Include the following in the request for Certificate of Construction-Phase Commissioning Process Completion:
  - a. Identify delayed tests by test number and title.
  - b. Written approval of proposed delayed tests, including approved schedule of completion of delayed tests.
2. Schedule and coordinate delayed tests. Schedule delayed tests when conditions that caused the delay have been rectified. Notify Engineer and Commissioning Authority at least three working days (minimum) in advance of tests.
3. Where delayed tests are approved, coordinate participation of necessary personnel and of Engineer, Commissioning Authority, and Owner's witness. Schedule delayed tests to minimize occupant and facility impact. Obtain Engineer's approval of the proposed schedule.

K. Commissioning Compliance Issues:

1. Test results that are not within the range of acceptable results are commissioning compliance issues.
2. Track and report commissioning compliance issues until resolution and retesting are successfully completed.

3. If a test demonstration fails, determine the cause of failure. Direct timely resolution of issue and then repeat the demonstration. If a test demonstration must be repeated due to failure caused by Contractor work or materials, reimburse Owner for billed costs for the participation in the repeated demonstration.
4. Test Results: If a test demonstration fails to meet the acceptance criteria, perform the following:
  - a. Complete a commissioning compliance issue report form promptly on discovery of test results that do not comply with acceptance criteria.
  - b. Submit commissioning compliance issue report form within 24 hours of the test.
  - c. Determine the cause of the failure.
  - d. Establish responsibility for corrective action if the failure is due to conditions found to be Contractor's responsibility.
5. Commissioning Compliance Issue Report: Provide a commissioning compliance issue report for each issue. Do not report multiple issues on the same commissioning compliance issue report.
  - a. Exception: If an entire class of devices is determined to exhibit the identical issue, they may be reported on a single commissioning compliance issue report. (For example, if all return-air damper actuators that are specified to fail to the open position are found to fail to the closed position, they may be reported on a single commissioning issue report. If a single commissioning issue report is used for multiple commissioning compliance issues, each device shall be identified in the report, and the total number of devices at issue shall be identified.
  - b. Complete and submit Part 1 of the commissioning compliance issue report immediately when the condition is observed.
  - c. Record the commissioning compliance issue report number and describe the deficient condition on the data form.
  - d. Resolve commissioning compliance issues promptly. Complete and submit Part 2 of the commissioning compliance issue report when issues are resolved.
6. Diagnose and correct failed test demonstrations as follows:
  - a. Perform diagnostic tests and activities required to determine the fundamental cause of issues observed.
  - b. Record each step of the diagnostic procedure prior to performing the procedure. Update written procedure as changes become necessary.
  - c. Record the results of each step of the diagnostic procedure.
  - d. Record the conclusion of the diagnostic procedure on the fundamental cause of the issue.
  - e. Determine and record corrective measures.
  - f. Include diagnosis of fundamental cause of issues in commissioning compliance issue report.
7. Retest:
  - a. Schedule and repeat the complete test procedure for each test demonstration for which acceptable results are not achieved. Obtain signature of Owner's witness on retest data forms. Repeat test demonstration until acceptable results are achieved. Except for issues that are determined to result from design errors or omissions, or

other conditions beyond Contractor's responsibility, compensate Owner for direct costs incurred as the result of repeated test demonstrations to achieve acceptable results.

- b. For each repeated test demonstration, submit a new test data form, marked "Retest."
8. Do not correct commissioning compliance issues during test demonstrations.
- a. Exceptions will be allowed if the cause of the issue is obvious and resolution can be completed in less than five minutes. If corrections are made under this exception, note the deficient conditions on the test data form and issue a commissioning compliance issue report. A new test data form, marked "Retest," shall be initiated after the resolution has been completed.

### 3.6 COMMISSIONING MEETINGS

- A. Schedule and conduct commissioning meetings. Comply with requirements in Section 01310 "Project Management and Coordination."

### 3.7 SEQUENCING

- A. Sequencing of Commissioning Verification Activities: For a particular material, item of equipment, assembly, or system, perform the following in the order listed unless otherwise indicated:
  - 1. Construction Checklists:
    - a. Material checks.
    - b. Installation checks.
    - c. Startup, as appropriate. Some startup may depend on component performance. Such startup may follow component performance tests on which the startup depends.
    - d. Performance Tests:
      - 1) Static tests, as appropriate.
      - 2) Component performance tests. Some component performance tests may depend on completion of startup. Such component performance tests may follow startup.
      - 3) Equipment and assembly performance tests.
      - 4) System performance tests.
      - 5) Intersystem performance tests.
  - 2. Commissioning tests.
- B. Before performing commissioning tests, verify that materials, equipment, assemblies, and systems are delivered, installed, started, and adjusted to perform according to construction checklists.

- C. Verify readiness of materials, equipment, assemblies, and systems by performing tests prior to performing test demonstrations. Notify Engineer if acceptable results cannot be achieved due to conditions beyond Contractor's control or responsibility.
- D. Commence tests as soon as installation checks for materials, equipment, assemblies, or systems are satisfactorily completed. Tests of a particular system may proceed prior to completion of other systems, provided the incomplete work does not interfere with successful execution of test.

### 3.8 SCHEDULING

- A. Commence commissioning process as early in the construction period as possible.
- B. Commissioning Schedule: Integrate commissioning activities into Construction Schedule. See Section 01320 "Construction Progress Documentation."
  - 1. Include detailed commissioning activities in monthly updated Construction Schedule and short-interval schedule submittals.
  - 2. Schedule the start date and duration for the following commissioning activities:
    - a. Submittals.
    - b. Preliminary operation and maintenance manual submittals.
    - c. Installation checks.
    - d. Startup, where required.
    - e. Performance tests.
    - f. Performance test demonstrations.
    - g. Commissioning tests.
    - h. Commissioning test demonstrations.
  - 3. Schedule shall include a line item for each installation check, startup, and test activity specific to the equipment or systems involved.
  - 4. Determine milestones and prerequisites for commissioning process. Show commissioning milestones, prerequisites, and dependencies in monthly updated critical-path-method construction schedule and short-interval schedule submittals.
- C. Two-Week Look-Ahead Commissioning Schedule:
  - 1. Two weeks prior to the beginning of tests, submit a detailed two-week look-ahead schedule. Thereafter, submit updated two-week look-ahead schedules weekly for the duration of commissioning process.
  - 2. Two-week look-ahead schedules shall identify the date, time, beginning location, Contractor personnel required, and anticipated duration for each startup or test activity.
  - 3. Use two-week look-ahead schedules to notify and coordinate participation of Owner's witnesses.
- D. Owner's Witness Coordination:
  - 1. Coordinate Owner's witness participation via Engineer.
  - 2. Notify Engineer of commissioning schedule changes at least two work days in advance for activities requiring the participation of Owner's witness.

### 3.9 COMMISSIONING REPORTS

#### A. Test Reports:

1. Pre-startup reports include observations of the conditions of installation, organized into the following sections:
  - a. Equipment Model Verification: Compare contract requirements, approved submittals, and provided equipment. Note inconsistencies.
  - b. Preinstallation Physical Condition Checks: Observe physical condition of equipment prior to installation. Note conditions including, but not limited to, physical damage, corrosion, water damage, or other contamination or dirt.
  - c. Preinstallation Component Verification Checks: Verify components supplied with the equipment, preinstalled or field installed, are correctly installed and functional. Verify external components required for proper operation of equipment correctly installed and functional. Note missing, improperly configured, improperly installed, or nonfunctional components.
  - d. Summary of Installation Compliance Issues and Corrective Actions: Identify installation compliance issues and the corrective actions for each. Verify that issues noted have been corrected.
  - e. Evaluation of System Readiness for Startup: For each item of equipment for each system for which startup is anticipated, document in summary form acceptable to Owner completion of equipment model verification, preinstallation physical condition checks, preinstallation component verification checks, and completion of corrective actions for installation compliance issues.
2. Test data reports include the following:
  - a. "As-tested" system configuration. Complete record of conditions under which the test was performed, including, but not limited to, the status of equipment, systems, and assemblies; temporary adjustments and settings; and ambient conditions.
  - b. Data and observations, including, but not limited to, data trend logs, recorded during the tests.
  - c. Signatures of individuals performing and witnessing tests.
  - d. Data trend logs accumulated overnight from the previous day of testing.
3. Commissioning Compliance Issue Reports: Report as commissioning compliance issues results of tests and test demonstrations that do not comply with acceptance criteria. Report only one issue per commissioning compliance issue report. Use sequentially numbered facsimiles of commissioning compliance issue report form included in this Section, or other form approved by Owner. Distribute commissioning compliance issue reports to parties responsible for taking corrective action. Identify the following:
  - a. Commissioning compliance issue report number. Assign unique, sequential numbers to individual commissioning compliance issue reports when they are created, to be used for tracking.
  - b. Action distribution list.
  - c. Report date.
  - d. Test number and description.
  - e. Equipment identification and location.

- f. Briefly describe observations about the performance associated with failure to achieve acceptable results. Identify the cause of failure if apparent.
  - g. Diagnostic procedure or plan to determine the cause (include in initial submittal)
  - h. Diagnosis of fundamental cause of issues as specified below (include in resubmittal).
  - i. Fundamental cause of unacceptable performance as determined by diagnostic tests and activities.
  - j. When issues have been resolved, update and resubmit the commissioning issue report forms by completing Part 2. Identify resolution taken and the dates and initials of the persons making the entries.
  - k. Schedule for retesting.
4. Weekly progress reports include information for tests conducted since the preceding report and the following:
  - a. Completed data forms.
  - b. Equipment or system tested, including test number, system or equipment tag number and location, and notation about the apparent acceptability of results.
  - c. Activities scheduled but not conducted per schedule.
  - d. Commissioning compliance issue report log.
  - e. Schedule changes for remaining Commissioning-Process Work, if any.
5. Data trend logs shall be initiated and running prior to the time scheduled for the test demonstration.
  - a. Trend log data format shall be multiple data series graphs. Where multiple data series are trend logged concurrently, present the data on a common horizontal time axis. Individual data series may be presented on a segmented vertical axis to avoid interference of one data series with another, and to accommodate different axis scale values. Graphs shall be sufficiently clear to interpret data within the accuracy required by the acceptance criteria.
  - b. Attach to the data form printed trend log data collected during the test or test demonstration.
  - c. Record, print out, and attach to the data form operator activity during the time the trend log is running. During the time the trend log is running, operator intervention not directed by the test procedure invalidates the test results.
6. System Alarm Logs: Record and print out a log of alarms that occurred since the last log was printed. Evaluate alarms to determine if the previous day's work resulted in any conditions that are not considered "normal operation."
  - a. Conditions that are not considered "normal operation" shall be reported on a commissioning issue report attached to the alarm log. Resolve as necessary. The intent of this requirement is to discover control system points or sequences left in manual or disabled conditions, equipment left disconnected, set points left with abnormal values, or similar conditions that may have resulted from failure to fully restore systems to normal, automatic control after test completion.



3.10 CERTIFICATE OF CONSTRUCTION-PHASE COMMISSIONING PROCESS COMPLETION

- A. When Contractor considers that construction-phase commissioning process, or a portion thereof which Owner agrees to accept separately, is complete, Contractor shall prepare and submit to Owner and Commissioning Authority through Engineer a comprehensive list of items to be completed or corrected. Failure to include an item on such list does not alter Contractor's responsibility to complete commissioning process.
- B. On receipt of Contractor's list, Commissioning Authority will make an inspection to determine whether the construction-phase commissioning process or designated portion thereof is complete. If Commissioning Authority's inspection discloses items, whether included on Contractor's list, which is not sufficiently complete as defined in "Construction-Phase Commissioning Process Completion" Paragraph in the "Definitions" Article, Contractor shall, before issuance of the Certificate of Construction-Phase Commissioning Process Completion, complete or correct such items on notification by Commissioning Authority. In such case, Contractor shall then submit a request for another inspection by Commissioning Authority to determine construction-phase commissioning process completion.
- C. Contractor shall promptly correct deficient conditions and issues discovered during commissioning process. Costs of correcting such deficient conditions and issues, including additional testing and inspections, the cost of uncovering and replacement, and compensation for Engineer's and Commissioning Authority's services and expenses made necessary thereby, shall be at Contractor's expense.
- D. When construction-phase commissioning process or designated portion is complete, Commissioning Authority will prepare a Certificate of Construction-Phase Commissioning Process Completion that shall establish the date of completion of construction-phase commissioning process. Certificate of Construction-Phase Commissioning Process Completion shall be submitted prior to requesting inspection for determining date of Substantial Completion.

END OF SECTION 01910

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## SECTION 03015 - MODIFICATIONS TO EXISTING 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:
  - 1. Cutting, removing, or modifying parts of existing concrete structures or appurtenances.
  - 2. Addressing existing steel reinforcing bars encountered.
  - 3. Bonding new concrete or grout to existing concrete.
- B. Related Requirements:
  - 1. Section 03303 “Miscellaneous Cast-In-Place Concrete” for concrete materials, and related work.
  - 2. Section 03150 “Concrete Joints and Accessories” for related work.
  - 3. Section 03600 “Grouting” for grout and related accessories.
  - 4. Section 05051 “Post-Installed Anchors” for anchors and related accessories.
  - 5. Section 05502 “Metals Fabrications” for various metals and related fabrications.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to modifications to existing concrete including, but not limited to, the following:
    - a. Verify specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
    - b. Materials, material application, sequencing, tolerances, and required clearances.
    - c. Quality-control program.
    - d. Coordination with building occupants.
  - 2. Attendees:
    - a. Owner.
    - b. Resident Engineer.
    - c. Contractor.
    - d. Engineer.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Submit manufacturer's technical literature and installation instructions that include:
    - a. Current printed recommendations and product data sheets for products including performance criteria, product life, working time after mixing, surface preparation and application requirements and procedures, curing, volatile organic compound data, and safety requirements.
    - b. Storage requirements including temperature, humidity, and ventilation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Documentation of the qualifications for Contractor qualifications, Manufacturer's qualifications, and Contractor's supervisor as specified in Part 1 "Quality Assurance" Article.
- B. Material Certificates: For each material provided.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Have a minimum of ten years' experience within last 10 years in manufacture and use of specified products and have an ongoing program of training, certifying, and technically supporting Contractor's personnel.
- B. Contractor Qualifications: Complete a program of instruction in application of approved manufacturer's material and provide certification from manufacturer attesting to their training and status as an approved applicator.
- C. Contractor's Supervisor: Have attended a training program sponsored by manufacturer supplying materials approved for this project.
- D. Manufacturer's Representative: A representative of product manufacturer who will visit the site for first three days of installation to give instructions to installation crew. Make periodic site visits to ensure products being installed are in accordance with published instructions.
- E. Be solely responsible for workmanship and quality of modification work. Inspections by the manufacturer, the Engineer, or others do not limit Contractor's responsibility for work quality.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials in original, new and unopened packages and containers clearly labeled with the following information:
  - 1. Manufacturer's name.
  - 2. Name or title of material, and other product identification.
  - 3. Manufacturer's stock number and batch number.

4. Date of manufacture.
  5. Instructions.
  6. Expiration date.
- B. Storage: Store products in accordance with manufacturers' published recommendations and the following supplementary requirements:
1. Store only approved materials on site and in locations as directed.
  2. Keep area clean and accessible.
  3. Comply with health and fire regulations including those of the Occupational Safety and Health Administration (OSHA).
- C. Handling: Handle products carefully and in accordance with manufacturers' published recommendations and the following supplementary requirements:
1. Prevent inclusion of foreign materials.
  2. Do not open containers or mix components until necessary preparatory work has been completed and application work will start immediately.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with this Section and applicable state and local regulations.
- B. Epoxy Bonding Agent:
1. Product: Two-component, solvent-free, asbestos-free moisture insensitive epoxy resin material used to bind plastic concrete to hardened concrete and complying with requirements of ASTM C 881, Type V, Grade 2, Class C.
- C. Epoxy Paste Adhesive:
1. Product: Two-component, solvent-free, moisture insensitive epoxy resin material used as an adhesive for mating surfaces where the glue line is 1/8 inch or less and to bond fresh, plastic concrete to clean, sound hardened concrete and complying with requirements of ASTM C 881, Type IV, Grade 3, Class C.
- D. Repair Mortar (Polymer-Modified Portland Cement Mortar):
1. Horizontal Surfaces:
    - a. Product: Two-component polymer-modified, portland cement based mortar used to repair horizontal surfaces with a migrating corrosion inhibitor and having a minimum compressive strength of 7,000 psi at 28 days tested in accordance with ASTM C 881 or ASTM C 109.

2. Vertical and Overhead Surfaces:

- a. Product: Two-component polymer-modified, portland cement based, fast setting, non-sag mortar used to repair vertical and overhead surfaces with a migrating corrosion inhibitor and having a minimum compressive strength of 5,000 psi at 28 days tested in accordance with ASTM C 881 or ASTM C 109.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which modification work is to be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.
- B. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting performance of the Work.

3.2 INSTALLATION - GENERAL

- A. Do not shift, cut, remove, or otherwise alter existing structure or concrete until authorization is given by the Engineer.
- B. When removing materials from or making openings in existing structures, take precautions and erect necessary barriers, shoring and bracing, and other protective devices. Prevent damage to structures beyond limits necessary for new work, protect personnel, control dust, and to prevent damage to structures or contents by falling or flying debris.
- C. Unless otherwise permitted, shown, or specified, cut existing concrete by line drilling.
- D. Construction Tolerances: Comply with requirements specified elsewhere in Division 03, except as modified herein, and elsewhere in Contract Documents.
- E. Make locations and phases of the work available for access by the Engineer or other personnel designated by the Engineer. Provide ventilation and safe access to the work.
- F. Cut, remove, or otherwise modify parts of existing structures or appurtenances as indicated, specified, or as necessary to complete the work. Finishes, joints, reinforcements, sealants, and similar materials are specified in their respective Sections. Install work complying with requirements of this Section and as indicated.
- G. Locations, details, and limits of modifications are indicated on Drawings. Comply with requirements of this Section and as indicated on Drawings.
- H. Examine areas and conditions under which modification work is to be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of work. Do not

proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

- I. Store, mix, apply, and cure materials in strict compliance with manufacturer's instructions.
- J. Where concrete is to be modified near an expansion joint or control joint, preserve isolation between components on either side of the joint.
- K. When drilling holes for dowels and bolts or when coring holes for slab or wall penetrations, stop drilling if reinforcing is encountered. Do not cut reinforcing without prior approval by the Engineer. Relocate hole to avoid reinforcing as approved by the Engineer.
  - 1. Identify reinforcing locations prior to drilling using reinforcing bar locators so that drill hole locations may be adjusted to avoid reinforcing interference.
- L. Saw-cut edges for modification areas vertically and horizontally straight. Make intersecting cuts perpendicular to each other.
- M. Stop saw cutting if reinforcing is encountered. Do not cut reinforcing without prior approval by the Engineer. Identify reinforcing locations within 1 foot of saw cut locations in any direction prior to saw cutting using reinforcing bar locators.
- N. Clean concrete surfaces of efflorescence, deteriorated concrete, dirt, laitance, and existing repair materials such as liners, adhesives, and epoxies. Remove foreign matter and deleterious films by sandblasting, oil-free air-blasting, scarifying, or other mechanical means to sound original concrete.
- O. Consolidate modification materials, completely filling portions of the area to be filled.
- P. Bring finished surfaces into alignment with adjacent existing surfaces to provide a uniform, flush, and even surface. Match repair surfaces to adjacent existing surfaces in texture including any coatings or surface treatments that had been provided for the existing structure.
- Q. Repair or replace concrete indicated or specified to be left in place that is damaged because of the work by approved means without additional compensation.

### 3.3 CONCRETE REMOVAL

- A. When removing materials from or making openings in existing structures, take precautions and erect necessary barriers, shoring and bracing, and other protective devices. Prevent damage to structures beyond limits necessary for new work, protect personnel, control dust, and to prevent damage to structures or contents by falling or flying debris.
- B. Concrete designated to be removed to specific limits indicated or directed by the Engineer, perform saw cutting 1 inch deep at limits of removal followed by line drilling and chipping, sandblasting, or oil-free airblasting, as appropriate in the areas where concrete is to be taken out. Remove concrete such that surrounding concrete and existing reinforcing to be left in place and existing in place equipment are not damaged.

1. Perform full thickness saw-cutting at limits of concrete to be removed only if indicated, herein specified, or after obtaining written approval from the Engineer.
- C. Where existing reinforcing is exposed due to saw cutting or line drilling and no new material is to be placed on cut surface, apply a 1/4 inchthick surface treatment of epoxy paste to entire cut surface.
- D. Where joint between new concrete or grout and existing concrete will be exposed in finished work, remove concrete edge by making a 1 inchdeep saw cut on each exposed surface of existing concrete or as indicated.

### 3.4 CONNECTION SURFACE PREPARATION

- A. Concrete areas requiring patching, repairs, or modifications, prepare connection surfaces as specified, as indicated, or as directed by the Engineer.
- B. Remove loose and deteriorated materials, efflorescence, existing repair materials, dirt, oil, grease, and other bond inhibiting materials from concrete surface by dry mechanical means such as sandblasting, chipping, wire brushing, or other mechanical means as approved by the Engineer.
  1. Uniformly roughen concrete surface to approximately 1/4 inch with pointed chipping tools. Thoroughly clean surface of loose or weakened material by sandblasting or air-blasting.
  2. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete.
- C. If reinforcing steel is exposed, mechanically clean to remove loose material, contaminants, and rust as approved by the Engineer. If half of reinforcing steel diameter is exposed, chip out behind the steel. Chip distance behind the steel to a minimum of 1 inch. Do not damage reinforcing to be incorporated in new concrete or repair mortar during removal operation.
- D. Clean reinforcing from existing removed or deteriorated concrete that is shown to be incorporated in new concrete or repair mortar by mechanical means to remove loose material and products of corrosion before proceeding. Cut, bend, or lap to new reinforcing as indicated and provide with 1 inch minimum clear cover.
- E. Use following specific concrete surface preparation Methods where indicated, specified, or as directed by the Engineer:
  1. Method A:
    - a. Roughen and clean existing concrete surface at connection.
    - b. Thoroughly saturate surfaces with water; prevent standing water during application.
    - c. Scrub cement paste (cement and water mixed to consistency of a thick paste) into substrate filling concrete pores and voids.
    - d. Place new concrete against scrub coat of cement paste while cement paste is still plastic.



2. Method B:
  - a. Roughen and clean existing concrete surface at connection.
  - b. Apply epoxy bonding agent at connection surfaces.
  - c. Place new concrete or grout mixture to limits indicated within time constraints recommended by manufacturer to ensure bond.
3. Method C:
  - a. Use adhesive anchoring system, as specified in Section 05051 “Post-Installed Anchors”, for installation of reinforcing steel dowels into existing concrete where indicated.
  - b. Perform installation complying strictly with manufacturer's recommendations, including drill bit diameter, surface preparation, injection, and installation of dowels.
  - c. Drill concrete to embedded deformed bars to indicated depths.
  - d. Use oil-free compressed air to blast out loose particles and dust from drilled holes. Clean dowels to be free of dirt, oil, grease, ice, or other deleterious material that would reduce bond.
  - e. Concrete in existing structures is considered to have a strength of 3,000 psi.
4. Method D:
  - a. Combination of Method B & Method C.

### 3.5 GROUTING

- A. Grout: As specified in Section 03600 “Grouting.”

### 3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed installations.
  1. Perform inspection with Contractor, material installer, and the Engineer present. Give minimum of 72 hours’ notice prior to time of inspection.
  2. Repair modifications not in conformance with Contract Documents in accordance with manufacturer's instructions at no additional cost to Owner.
  3. At completion of non-conforming repairs, Contractor, material installer, and the Engineer shall reinspect the repaired problem areas.
  4. Prepare inspection reports, identifying acceptable work, type and locations of unacceptable work, and actions taken to correct unacceptable work.
  5. Complete field quality control work without additional compensation.

END OF SECTION 03015

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## SECTION 03150 - CONCRETE JOINTS AND ACCESSORIES

### 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 construction of durable, watertight joints in concrete structures.
- B. Related Requirements:
  - 1. Section 03303 “Miscellaneous Cast-In-Place Concrete” for cement, and related concrete products.
  - 2. Section 03600 “Grout” for grout related work.
  - 3. Section 03015 “Modifications to Existing Concrete”.
  - 4. Section 05502 “Metal Fabrications” for various metal fabrications.

#### 1.3 ACTION SUBMITTALS

- A. Plastic Waterstops: Product data including sample, catalogue cut, dimensions, technical data, storage requirements, splicing methods, conformity to CRD standards, details and samples of factory fabrications.
- B. Premolded Joint Fillers: Product data including location of use, sample, catalogue cut, technical data, storage requirements, and conformity to ASTM standards.
- C. Preformed Expansion Joint Material: Product data including location of use, catalogue cut, dimensions, technical data, storage requirements, installation instructions, and conformity to ASTM standards.
- D. Bond Breaker: Product data including location of use, catalogue cut, technical data, storage requirements, and application instructions.
- E. Expansion Joint Dowels: Product data on the complete assembly including dowel material, sizes and dimensions, coatings, expansion dowel caps, installation instructions and conformity to ASTM standards.
- F. Sealant: Product data including location of use, catalogue cut, technical data, storage requirements, mixing and application instructions, and conformity to ASTM standards.

- G. Neoprene Bearing Pads: Product data including location of use, sample, catalogue cut, dimensions, technical data, storage requirements, installation instructions, and conformity to AASHTO standards.

#### 1.4 INFORMATIONAL SUBMITTALS

##### A. System and Material Certificates:

1. Certify that materials used within joint system are compatible with each other.
2. Certify that sealant is made for use in continuous immersion in contact with wastewater.

#### 1.5 QUALITY ASSURANCE

1. Experience: Performed at least five projects of similar size and complexity within last five years. Be present at work site prior to mixing to instruct on mixing, application, and inspection procedures. Inspect finish of prepared surfaces prior to sealant application.
2. Make at least one additional visit to site as the work progresses and report on each visit to Contractor and the Engineer. Advise whether the application is in accordance with this Section and manufacturer's printed installation instructions.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

- A. Use materials in a given joint that are compatible with one another. Coordinate selection of suppliers and products to provide compatibility. Do not use asphaltic bond breakers or asphaltic joint fillers in joints receiving sealant.

#### 2.2 MATERIALS - STANDARD WATERSTOPS

- A. Plastic Waterstops: Conform to CRD C572, fabricate by extruding elastomeric plastic compound with virgin polyvinylchloride as basic resins and with compound containing no reprocessed materials. Incorporate an integral fastening system or provide with grommets or prepunched holes between outermost ribs at a spacing of 12 inches on center.
  1. Waterstops For Expansion Joints:
    - a. Type: Ribbed type waterstops with a center bulb.
    - b. Minimum Tensile Strength: 1,750 psi per ASTM D 638.
    - c. Size: 9 inches (228.6 mm) by 3/8 inch.
    - d. Acceptable Manufacturers: Provide products manufactured by one of the following or equal:
      - 1) Greenstreak Plastic Products: Style 696.
      - 2) Paul Murphy Plastics Co.: Style CR-9380.
      - 3) Vinylex Corp.: Style RLB9-38.

2. Waterstops For Non-Expansion Joints and Joints Indicated:
  - a. Type: Ribbed type waterstops.
  - b. Minimum Tensile Strength: 1,750 psi per ASTM D 638.
  - c. Size: 6 inches by 3/8 inch.
  - d. Acceptable Manufacturers: Provide products manufactured by one of the following or equal:
    - 1) Greenstreak Plastic Products: Style 679.
    - 2) Paul Murphy Plastics Co.: Style FR-6380.
    - 3) Vinylex Corp.: Style R6-38.
  
3. Factory Fabrications:
  - a. Provide factory fabrications for waterstop changes of direction, transitions, and intersections:
    - 1) Intersections: Vertical ells, flat ells, vertical tees, flat tees, vertical crosses, flat crosses, and special, unusual, or complicated intersections including waterstop intersections of different sizes or configurations, and intersections due to joint offsets.
  - b. Make and inspect factory fabrications by waterstop manufacturer.
  - c. Provide stub ends of sufficient length to leave only straight butt joints for field splicing.

## 2.3 MATERIALS - SPECIAL WATERSTOPS

### A. Base Seal PVC Waterstops:

1. Conform to CRD C572 and fabricate by extruding elastomeric plastic compound with virgin polyvinylchloride as basic resins with compound containing no reprocessed materials.
2. Minimum Tensile Strength: 1,750 psi per ASTM D 638.
3. Basis-of-Design: Provide products as manufactured by Greenstreak Plastic Products, or equal:
  - a. Expansion Joints: Style 925.
  - b. Control Joints: Style 928.
  - c. Construction Joints: Style 927.

### B. PVC Retrofit Waterstops for Non-Expansion Joints:

1. Conform to CRD C572 and fabricate by extruding elastomeric plastic compound with virgin polyvinylchloride as basic resins with compound containing no reprocessed materials.
2. Minimum Tensile Strength: 1,750 psi (12.0 mPa) per ASTM D 638.
3. Type: T profile.
4. Basis-of-Design: Provide products as manufactured by Greenstreak Plastic Products, or equal.

- a. Style 609 system complete with Type 304 stainless-steel batten bars and 1/4 inch diameter stainless-steel expansion bolts.
- C. Expansive Waterstops for Construction Joints Where Indicated:
- 1. Type A - Preformed Bentonite and Butyl Rubber Based System:
    - a. Installation Adhesives: Use with expansive waterstops as recommended by waterstop manufacturer.
    - b. Acceptable Manufacturers: Provide products manufactured by one of the following or equal:
      - 1) Colloid Environmental Technologies Company: Volclay Waterstop-RX101.
      - 2) Greenstreak Plastic Products: 3/4-in by 1-in Swellstop.
      - 3) W.R. Grace: Adcor ES.
- D. Preformed Adhesive Waterstops for Construction Joints Where Indicated.
- 1. System: Rope type preformed plastic waterstop meeting requirements of Federal Specification SS-S-210A.
  - 2. Cross-Sectional Area: Approximately one square inch, unless otherwise indicated.
  - 3. Certify waterstop by NSF/ANSI Standard 61.
  - 4. Primer: As recommended by waterstop manufacturer.
  - 5. Basis-of-Design: Provide products as manufactured by Henry Company, or equal:
    - a. Synko-Flex Waterstop SF-302.

## 2.4 MATERIALS - ACCESSORIES

- A. Premolded Joint Filler - Structures: ASTM D 1752, Type III, self-expanding cork.
- 1. Thickness: 1 inch, unless otherwise indicated.
- B. Bond Breaker:
- 1. Bond Breaker Tape: Adhesive-backed glazed butyl or polyethylene tape that adheres to premolded joint filler or concrete surface. Provide tape of same width as the joint.
  - 2. Bond breaker for concrete other than where tape is indicated or specified: Either bond breaker tape or a non-staining type bond prevention coating.
    - a. Acceptable Coating Manufacturers: Provide products manufactured by one of the following or equal:
      - 1) Cresset Chemical Company: Crete-Lease Bond Breaker for Tilt-Up.
      - 2) Dayton Superior: Sure-Lift J-6 WB.
      - 3) Nox-Crete: Silcoseal Select.
  - 3. Bond Breaker for Expansion Joint Dowels: ASTM C 309, Type 2, Class A, water-based white pigmented curing compound.

- C. Preformed Expansion Joint Material: Non-extrudable watertight strip material used to fill expansion joints between structures meeting following criteria:
  - 1. Compressibility: Capable of being compressed at least 40 percent for 70 hours at 68 degrees F and subsequently recovering at least 20 percent of its original thickness in first 30 minutes after unloading.
  - 2. Basis-of-Design: Provide products as manufactured by Chase Construction Products, or equal:
    - a. Phyzite 380.
- D. Expansion Joint Dowels: Smooth undeformed steel bars conforming to ASTM A 675, Grade 70 or Type 316 Stainless Steel, or unless noted otherwise in contract drawings.
  - 1. Provide dowels straight and clean, free of loose flaky rust, and loose scale.
  - 2. Dowels may be sheared to length provided deformation from true shape caused by shearing does not exceed 0.04 inch of dowel diameter and extends no more than 0.04 inch from the end.
  - 3. Coat bars with a bond breaker on expansion end of dowel. Provide expansion dowel caps on the expansion end.
    - a. Acceptable Manufacturers for Expansion Dowel Caps: Provide products manufactured by one of the following or equal:
      - 1) Dayton Superior Corporation: Style K-11.
      - 2) Heckmann Building Products, Inc.: No. 87.
      - 3) Meadow Steel Products, Inc.: Style 3070 Expansion Tube.
- E. Neoprene Bearing Pads: 50 durometer conforming to AASHTO Standard Specifications for Highway Bridges.
- F. Grout: Non-metallic, non-shrinking as specified in Section 033600 "Grouting."

## 2.5 MATERIALS - SEALANTS

- A. Sealant:
  - 1. Comply with ASTM C 920 for following conditions:
    - a. Sealant for Joints in Horizontal Surfaces: Type S or M, Grade P or NS, Class 25.
    - b. Sealant for Joints in Sloping and Vertical Surfaces: Type S or M, Grade NS, Class 25.
    - c. Sealant in Pedestrian and Vehicular Traffic Areas: [Use T<sub>1</sub>] [Use T<sub>2</sub>].
    - d. Sealant in Non-Traffic Areas: Type S or M, Grade P, Use NT.
  - 2. Provide sealants made for use in continuous immersion in contact with wastewater. Provide gray colored sealants unless otherwise indicated, specified, or approved.

## PART 3 - EXECUTION

### 3.1 INSTALLATION - WATERSTOPS, GENERAL

- A. Install waterstops for joints indicated and according to manufacturer's published installation instructions and approved submittals.
- B. Include waterstops continuous around corners and intersections to provide a continuous seal.
- C. Provide a minimum number of connections or splices. Replace connections or splices that do not meet specified requirements at no additional cost to Owner.
- D. Secure waterstops in joints before concrete is placed.
- E. Install plastic waterstops so that half of width is embedded on each side of joint. Provide waterstops completely embedded in void-free concrete.
- F. Terminate waterstops 2 inch below exposed top of walls.
- G. Protect waterstops from damage in intervals between placing waterstops and subsequent placing of concrete. Replace damaged or punctured waterstops at no additional cost to Owner.
- H. Protect plastic waterstops from sunlight when exposed more than 30 days between concrete placements.
- I. Provide waterstops free from form release agent, bond breaker, dirt, concrete splatter, ice, mortar, paint, or other deleterious material that could reduce or destroy bond between waterstop and adjacent concrete.

### 3.2 INSTALLATION - PLASTIC WATERSTOPS

- A. Field Splices: Make only straight butt joints. Fabricate splices on a bench.
  - 1. Use a power saw and guide to cut straight ends to be spliced.
  - 2. Heat fuse weld splices using a Teflon coated thermostatically controlled waterstop splicing iron following manufacturer's recommendations.
  - 3. Provide finished splices having a cross-section that is dense and free of porosity. Engineer may conduct destructive tests of splices by cutting along one-half of splice length and by cutting perpendicular to splice at several locations on remaining half of splice length.
  - 4. Completed Splices: Exhibit a continuous and uniform bead of excess melted material with welded material looking similar to parent material.
  - 5. Show no misalignment of center bulbs or ribs greater than 1/16 inch, lack of fusion, porosity, pinholes, cracks, charred or burnt material, bubbles, or separation of cooled splice when bent by hand. If a splice displays any of these defects, reject the splice, recut back at least 1 inch from rejected splice on each side, and reweld.
- B. Secure waterstops in wall joints before concrete is placed. If waterstop does not incorporate an integral fastening system, grommets, or prepunched holes, drill holes in waterstops between



outermost ribs at each edge. Center waterstop in the joint. Tie both edges of waterstop to reinforcing steel with tie wire as specified for tying reinforcing steel. Secure waterstop centered on and perpendicular to joint and to maintain its position during concrete placement.

- C. Space waterstop ties to match spacing of adjacent reinforcing, but ties need not be spaced closer than 12 inches on center.
- D. Clamp horizontal waterstops in slabs in position with form bulkhead, unless previously set in concrete. Lift waterstop edge while placing concrete below the waterstop. Manually force waterstop against and into placed concrete and cover with fresh concrete, to provide complete encasement of waterstop in concrete.

### 3.3 INSTALLATION - SPECIAL WATERSTOPS

- A. Install special waterstops at joints only where specifically indicated on Drawings. Provide waterstops continuous around corners and intersections to provide a continuous seal.
- B. Use waterstops of maximum practicable length to provide a minimum number of joints, connections, or splices. Make joints, connections, and splices conforming to manufacturers' recommended.
- C. Terminate waterstops 2 inches below exposed top of walls.
- D. Plug bulbs in PVC retrofit waterstops with foam rubber, 1 inch deep, at termination points.
- E. Base Seal PVC Waterstops: Splice as specified for plastic waterstops. Set base seals for expansion joints on concrete sleepers, not less than 24 inches wide, and sleeper covered with two layers of sheet material such as vapor barrier material.
  - 1. Do not fasten base seal by nails, but firmly hold in position by bulkhead form. Base seals at non-expansion joints may be set on vapor barrier material that extends at least two feet on each side of the joint.
- F. PVC Retrofit Waterstops: Splice and secure projecting portion to reinforcing steel as specified for plastic waterstops. Clean existing concrete of foreign material and patch to form a smooth plane surface. Use adhesives, fastening devices, and fastener spacing conforming to manufacturer's recommendations.
- G. Expansive Type and Preformed Adhesive Waterstops:
  - 1. Clean and prepare joint surfaces, install primers or adhesives, and install preformed adhesive waterstops on dry surfaces in accordance with manufacturer's instructions, including concrete cure, temperature conditions, and splices.
  - 2. Use mechanical fasteners to secure, preformed expansive waterstops to previously placed vertical and overhead concrete surfaces and other locations, as recommended by manufacturer. Protect installed waterstops from moisture and keep dry until subsequent placement of concrete.

### 3.4 INSTALLATION - CONSTRUCTION JOINTS

- A. Make construction joints only at locations indicated or as approved by the Engineer. Submit additional or relocation of construction joints proposed by Contractor to the Engineer for written approval. Do not eliminate construction joints.
- B. Locate additional or relocated joints where they least impair member strength. In general, locate joints within middle third of spans of slabs, beams, and girders.
  - 1. If a beam intersects a girder at joint, offset joint a distance equal to twice the width of member being connected.
  - 2. Locate joints in walls and columns at underside of floors, slabs, beams, or girders and at tops of footings or floor slabs.
  - 3. Do not locate joints between beams, girders, column capitals, or drop panels and the slabs above them. Do not locate joints between brackets or haunches and walls or columns supporting them.
- C. Unless otherwise indicated, provide joints perpendicular to main reinforcement. Continue reinforcing steel through joint as indicated.
- D. Provide waterstops in wall and slab construction joints in liquid retaining structures and at other locations indicated.
- E. Roughened Construction Joints:
  - 1. At construction joints and at concrete joints indicated, uniformly roughen concrete surface with chipping tools to expose a fresh face 1/4 inch of a full amplitude, distance between high and low points and side to side.
  - 2. Thoroughly clean joint surfaces of loose or weakened materials by waterblasting or sandblasting and prepare for bonding.
  - 3. At least two hours before and again shortly before new concrete is deposited, saturate joints with water.
  - 4. After glistening water disappears, coat joints with neat cement slurry mixed to consistency of very heavy paste. Apply a coating to surfaces at least 1/8 inch, scrubbed-in by means of stiff bristle brushes. Deposit new concrete before neat cement dries.

### 3.5 INSTALLATION - EXPANSION JOINTS

- A. Make expansion joints at locations indicated. Do not eliminate or relocate expansion joints.
- B. Provide expansion joints 1 inch in thickness, unless otherwise indicated.
- C. Provide center bulb type waterstops, sealant grooves, and sealants in wall and slab expansion joints in liquid retaining structures and at other locations indicated.
- D. Do not extend through expansion joints, reinforcement or other embedded metal items that are continuously bonded to concrete on each side of joint.
- E. Where indicated, install smooth dowels at right angles to expansion joints. Align dowels parallel with finished surface. Rigidly hold in place and support during concrete placement.

1. Unless otherwise indicated, apply a bond breaker to one end of dowels through expansion joints.
  2. Mask waterstops to prevent bond breaker from running or dripping onto them. Remove masking prior to concrete placement.
  3. Provide expansion dowel caps on ends of expansion joint dowels to which bond breaker has been applied.
- F. Place joint filler over joint face allowing for sealant grooves as indicated. Butt joint filler tight against waterstop, if present. Tape joint filler splices to prevent intrusion of mortar. Position premolded joint filler material parallel to finished surfaces. Secure joint filler against displacement during concrete placement and consolidation. Seal expansion joints as indicated.

### 3.6 INSTALLATION - PARTIAL CONTRACTION JOINTS

- A. Make partial contraction joints at locations indicated. Do not eliminate or relocate partial contraction joints.
- B. Provide waterstops, sealant grooves, and sealants in wall and slab partial contraction joints in liquid retaining structures and at other locations indicated.
- C. Extend every other bar of reinforcing steel through partial contraction joints or as indicated on Drawings. Coat concrete surface with a bond breaker prior to placing new concrete against it as indicated on Drawings.
  1. Do not coat reinforcement or waterstops with bond breaker. Mask waterstops and reinforcing passing through joint to prevent bond breaker from running or dripping on to them. Remove masking prior to concrete placement.

### 3.7 INSTALLATION - SEALANTS

- A. Install sealants in clean dry recesses free of frost, oil, grease, form release agent, loose material, laitance, dirt, dust, and other deleterious materials that will impair bond.
- B. Apply sealant conforming to manufacturer's recommendations including concrete cure, temperature, moisture, mixing, primer, primer cure time, joint and recess preparation, tooling, and curing.
- C. Apply masking tape to each side of joint prior to sealant installation. Remove masking tape afterwards, along with any spillage to leave a sealant installation with neat straight edges.

### 3.8 INSTALLATION - PREFORMED EXPANSION JOINT MATERIAL

- A. Install preformed expansion joint material in conformance with manufacturer's recommendations; including surface preparation, adhesive installation, heat welding, and set time.

### 3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect system components verifying that installation conforms to manufacturer's installation instructions.,
  - 1. Prepare test and inspection reports.

### 3.10 CLEANING AND PROTECTION

- A. Clean adjacent surfaces removing excess spills.
- B. Protect installed products until subsequent work is installed. For exposed materials, protect from damage until Substantial Completion.

END OF SECTION 03150

## SECTION 03303 – MISCELLANEOUS 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 03600 “Grouting” for grouting.
  - 2. Section 05051 “Post-Installed Anchors” for post installed adhesive anchoring system.

#### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with fly ash or ground granulated blast furnace slag; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Concrete Design Mixtures: Design Mixtures: For each formulation of concrete proposed for use, submit constituent quantities per cubic yard (cubic meter), water cementitious ratio, air content, concrete slump, type and manufacturer of cement and type and manufacturer of fly ash or ground granulated blast furnace slag. Provide either:
  - 1. Standard deviation data for each proposed concrete mix based on statistical records.
  - 2. Water cementitious ratio curve for concrete mixes based on laboratory tests.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, spacing, lengths, material, grade, bar schedules, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, and supports for concrete reinforcement. Reference bars to be the same identification marks shown on the bar bending details.
- D. Construction Joint Layout: As shown on the Drawings.

- E. Material Certificates: For each of the following:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Form materials and form-release agents.
  - 4. Steel reinforcement and accessories.
  - 5. Curing compounds.
  - 6. Bonding agents.
  
- F. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Aggregates: Conformance to ASTM standards, including sieve analysis, mechanical properties, and deleterious substance content, and mortar bar expansion test results.
  - 2. Mill Test Reports: Conformance to ASTM standards, including chemical analysis and physical tests.
    - a. Cementitious materials.
    - b. Steel Reinforcing.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For independent testing agency responsible for concrete design mixtures.
  
- B. Certifications:
  - 1. Certify that admixtures used in the same concrete mix are compatible with each other and the aggregates.
  - 2. Certificate of conformance for concrete production facilities from the NRMCA.
  
- C. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE

- A. 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."
  
- B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C1077 and ASTM E329 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.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Provide reinforcement free from mill scale, rust, mud, dirt, grease, oil, ice, or other foreign matter that will reduce or destroy bond. Deliver, store, and handle steel reinforcement to prevent bending and damage. Store reinforcement off the ground, protect from moisture, and keep out of standing water, and free from rust, mud, dirt, grease, oil, ice, or other contaminants and deleterious matter that will reduce or destroy bond.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions. Limit total storage time from date of manufacture to date of installation to six months or the manufacturer's recommended storage time, whichever is less.
- D. Remove immediately from the site material which becomes damp, contains lumps, or is hardened and replace with acceptable material.
- E. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location.
  - 2. Provide additional protection according to manufacturer instructions.

## 1.8 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 of the highest and lowest temperature from midnight to midnight is expected to fall below 40 deg F for three successive days, maintain delivered concrete 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.
- 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. Surface Finish 2.0 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. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- C. 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. Form-release agent to comply with Federal, State and local VOC limitations.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete, heavy high frequency vibration of the 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 retaining walls.

### 2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, new deformed bars.
- B. Steel Bar Mats: ASTM A184/A184M, fabricated from ASTM A615/A615M, Grade 60, deformed bars, assembled with clips.
- C. Welded Wire Fabric: ASTM A184, fabricated from ASTM A615, Grade 60 ksi.



## 2.4 REINFORCEMENT ACCESSORIES

- A. 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 of greater compressive strength than the specified concrete strength, according to CRSI's "Manual of Standard Practice," 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.
- B. Tie wires for reinforcement: 16 gauge or heavier black annealed wire to tie uncoated reinforcing.

## 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 C150/C150M, Type II. Total equivalent alkali content of the cement used not to exceed 0.60 percent as provided in the Optional Chemical Requirements of ASTM C150.
  - 2. Fly Ash: ASTM C618, Class F.
  - 3. Ground Granulated Blast Furnace Slag: ASTM C989/C989M, Grade 100 or 120.
- C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Maximum Coarse-Aggregate Size: As indicated by concrete mixtures specified herein.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. 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 C494/C494M, Type A.
  - 2. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
- E. Water: ASTM C94/C94M and potable.

## 2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1-D, Class B, dissipating.

## 2.7 RELATED MATERIALS

- A. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types V, load bearing, for bonding freshly mixed concrete to hardened concrete.

## 2.8 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 (Portland cement alone or in combination with fly ash or Ground Granulated Blast Furnace Slag) in concrete as follows:
  - 1. Fly Ash: 25 percent.
  - 2. Ground Granulated Blast Furnace Slag: 50 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing admixture in concrete, for placement and workability.
  - 2. High-range water-reducing admixture in concrete, may be used, for placement and workability.

## 2.9 CONCRETE MIXTURES

- A. Concrete Fill and Electrical Raceway Encasement:
  - 1. Minimum Compressive Strength: 2500 psi at 28 days.
  - 2. Maximum W/C Ratio: 0.62.
  - 3. Slump Limit: **3 inches** plus or minus 1 inch.
  - 4. Air Content: 4 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
  - 5. Coarse Aggregate: ASTM C33, size 57 for concrete fill.
- B. Structural Concrete 16-in or greater in thickness.
  - 1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Maximum W/C Ratio: 0.42.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery.
5. Coarse Aggregate: ASTM C33, size 467.

C. Structural Concrete 10-in or greater in thickness:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum W/C Ratio: 0.42.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 4 percent, plus or minus 1.5 percent at point of delivery.
5. Coarse Aggregate: ASTM C33, size 57.

D. Structural Concrete 10-inch or less in thickness:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum W/C Ratio: 0.42.
3. Slump Limit: 4 inches, plus or minus 1 inch Air Content: 4 percent, plus or minus 1.5 percent at point of delivery.
5. Coarse Aggregate: ASTM C33, size 67.

## 2.10 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, 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.

## PART 3 - EXECUTION

### 3.1 FORMWORK INSTALLATION

- A. Erect, 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. Use form-facing materials as required to meet the surface finishes (SF) requirements of ACI 301, unless otherwise specified provide as-cast form finishes per ACI 301 as follows.

1. Surface Finish (SF-2.0)

- D. Construct forms tight 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 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 necessary. 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, 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, ice, snow 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.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for 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 must be maintained.

1. Leave formwork for structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing materials are not acceptable for exposed surfaces. Re-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 Engineer.

### 3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose mill scale, rust, mud, dirt, grease, oil, ice, and other foreign materials that reduce or destroy the bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum clear concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Splicing:
  1. Lengths and locations of splices as indicated on the Drawings.
  2. If not indicated on Drawings, locate reinforcement splices at point of minimum stress.

### 3.5 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 Engineer.
  1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
  2. Locate joints for foundations in the middle third of spans.
  3. Locate horizontal joints in walls and at the top of footings.
  4. Space vertical joints in walls as indicated on the Drawings.
  5. At construction joints and at concrete joints indicated on Drawings to be "roughened", uniformly roughen the surface of concrete to a full amplitude (distance between high and low points and side to side) of 1/4 inch with chipping tools to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by waterblasting or sandblasting and prepare for bonding. At least two hours before and again shortly before the new concrete is deposited, saturate joints with water. After glistening water disappears, coat joints with neat cement slurry mixed to consistency of very heavy paste.

Coat surfaces to a depth of at least 1/8 inch thick, scrubbed-in by means of stiff bristle brushes. Deposit new concrete before the neat cement dries.

6. Do not use keyways in construction joints unless specifically shown on the Drawings or approved by the Engineer.

### 3.6 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 Engineer.
- C. 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 "cold" 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.
  4. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- D. Slabs and equipment foundations:
  1. Maintain reinforcement in position on chairs during concrete placement.
  2. Screed surfaces with a straightedge and strike off to correct elevations.
  3. Slope surfaces uniformly to drains where required.
  4. 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.

### 3.7 FINISHING SURFACES

- A. Finish concrete surfaces according to ACI 301.
- B. Surface Finish 2.0: 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 view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply a Grout-Cleaned Rubbed Finish per ACI 301 to exposed Surface Finish 2.0 as-cast vertical concrete surfaces as specified.
- D. Float Finish: Apply float finish per ACI 301 prior to broom finish or trowel finish.
- E. Broom Finish: After concrete has received a float finish, apply to smooth-formed-finished as-cast concrete surfaces subject to pedestrian traffic. Provide broom finish perpendicular to direction of pedestrian traffic.
- F. Trowel Finish: After concrete has received a float finish, apply to smooth-formed-finished horizontal interior as-cast concrete surfaces.
- G. 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.

### 3.8 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. 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.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and chamfers.
- C. Equipment Pads:
  1. Coordinate sizes and locations of concrete pads with actual equipment provided.
  2. Install reinforcing dowels; to connect concrete pad to concrete floor, unless otherwise indicated.
  3. For supported equipment, install anchor bolts that extend through concrete pad and anchor into structural concrete substrate.
  4. Prior to placing concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  5. Cast anchor-bolt insert into pads. Install anchor bolts to elevations required for proper attachment to supported equipment.

### 3.9 CONCRETE PROTECTION 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. Formed Surfaces: Cure formed concrete 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.
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- D. 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. 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.

### 3.10 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer'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. Repair surfaces containing defects. Surface defects include color and texture irregularities, voids, cracks, spalls, air bubbles, bug holes, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
- D. Limit sawcut at the perimeter of the area to a depth of 3/4 inch. Make edges of cuts perpendicular to concrete surface. Prepare surfaces per patching mortar manufacturer's recommendations.
- E. Repairing Formed Surfaces:
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. 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 using patching mortar. On surfaces exposed to view repair 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 Engineer.

F. Repairing Unformed Surfaces:

1. Inspect unformed surfaces, such as tops of foundations or equipment pads, for finish and verify surface tolerances specified for each surface.
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. Limit sawcut at the perimeter of the area to a depth of 3/4 inch. Finish repaired areas to blend into adjacent concrete.
4. Repair defective areas, 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. Mix patching mortar per manufacturer's recommendations, including coarse aggregate when required. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
5. Correct 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.

G. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

H. Repair materials and installation not specified above may be used, subject to Engineer's approval.

### 3.11 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing and inspection agency to perform field tests and inspections and prepare test reports.
- B. Notify the Owner when the reinforcing is complete and ready for inspection, at least six working hours prior to the proposed concrete placement. Do not cover reinforcing steel with concrete until the installation of the reinforcement, including the size, spacing and position of the reinforcement has been inspected by the Owner's inspection agency and the Owner's inspection agency release to proceed with the concreting has been obtained. Keep forms open until the Owner's inspection agency has completed inspection of the reinforcement.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements by the Owner's testing agency:

1. Testing Frequency: One composite sample for each day's placement 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.
  - 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.
2. Slump: ASTM C143/C143M; one test at point of discharge for each composite sample, but not less than one test for each day's placement of each concrete mixture. Additional tests will be performed when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M, pressure method, for concrete; one test for each composite sample at the point of placement, but not less than one test for each day's placement of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; 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.
5. Compression Test Specimens: ASTM C31/C31M.
  - a. Cast and cure one set of five 6 inch x 12 inch long standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at 7 days, test one specimen at 14 days, test two specimens at 28 days. The fifth may be used to verify strength after 28 days if the 28-day test results are low.
7. 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.
8. Test results shall be reported in writing to Engineer, 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.
9. 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 Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Engineer.
10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 03303

## SECTION 03600 - GROUTING

### 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. Portland cement grout.
2. Cement grout.
3. Nonshrink epoxy grout.
4. Nonshrink cementitious grout.

- B. Related Requirements:

1. Section 03015 "Modifications to Existing Concrete".
2. Section 03150 "Concrete Joints and Accessories."
3. Section 03303 "Miscellaneous Cast-in-Place Concrete."
4. Section 05502 "Metal Fabrications" for grout related to miscellaneous metals.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer information regarding grout and surface preparation, mixing and installation.

1. Commercially manufactured nonshrink cementitious grout. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, and conformity to the specified ASTM standards.
2. Commercially manufactured nonshrink epoxy grout. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, and conformity to the specified ASTM standards.
3. Cement grout. Include the type and brand of cement, the gradation of fine aggregate, product data on any proposed admixtures and the proposed grout mix.
4. Concrete grout. Include data as required for concrete and for fiber reinforcement as delineated in Section 033010 "Miscellaneous Cast-In-Place Concrete."

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

- B. Manufacturer Instructions: Submit instructions for mixing, handling, surface preparation, and placing epoxy-type and nonshrink grouts.
- C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- D. Qualifications Statement:
  - 1. Submit qualifications for manufacturer.
- E. Product Certificates: Provide certification of the following:
  - 1. Manufactured grout products and admixtures for cement grout and concrete grout are made for use in contact with potable water 30 days after installation (non-toxic and free of taste and odor).

## 1.5 QUALITY ASSURANCE

- A. Perform Work according to ASTM standards.
- B. Maintain one copy of each standard affecting Work of this Section on Site.
- C. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years' experience in production and use of provided grouts.
- D. Independent testing laboratory shall meet the requirements of ASTM E329 and ASTM C1077 and be acceptable to the Engineer. Laboratories affiliated with the Contractor or in which the Contractor or officers of the Contractor's organization have beneficial interest are not acceptable.
- E. Pre-installation Meeting: At least ten working days before grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing and curing procedures for each product proposed for use. Notify all parties involved with grouting, including the Engineer, of the meeting at least ten working days prior to its scheduled date.
- F. Services of Manufacturer's Representative: Provide services of a field technician of the nonshrink grout manufacturer [epoxy grout manufacturer] who has performed at least five projects of similar size and complexity during the last five years, to attend the pre-installation meeting, to be present for the initial installation of each type of nonshrink grout, and to correct installation problems.
- G. Field Testing:
  - 1. All field testing and inspection services will be provided by Owner. Assist in the sampling of materials and cooperate by allowing free access to the work and permitting the use of ladders, scaffolding, and such incidental equipment as may be required. Methods of testing will comply with the applicable ASTM Standards.
- H. Field testing of concrete grout will be as specified for concrete in Section 033010 "Miscellaneous Cast-In-Place Concrete."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Store materials according to manufacturer instructions. Limit total storage time from date of manufacture to date of installation to six months or the manufacturer's recommended storage time, whichever is less.
- C. Remove immediately from the site material which becomes damp, contains lumps, or is hardened and replace with acceptable material.
- D. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location.
  - 2. Provide additional protection according to manufacturer instructions.

## 1.7 AMBIENT CONDITIONS

- A. Maximum Conditions: Do not perform grouting if temperatures exceed 90 degrees F.
- B. Minimum Conditions: Do not perform grouting if the minimum temperature of base plates, supporting concrete and grout are less than 40 degrees F. Maintain minimum temperature of 40 degrees F before, during, and after grouting, until grout has set.

## PART 2 - PRODUCTS

### 2.1 PORTLAND CEMENT GROUT

- A. Portland Cement: Comply with ASTM C150/C150M, Type I and II.
- B. Water:
  - 1. Potable.
  - 2. No impurities, suspended particles, algae, or dissolved natural salts in quantities capable of causing:
    - a. Corrosion of steel.
    - b. Volume change increasing shrinkage cracking.
    - c. Efflorescence.
    - d. Excess air entraining.
- C. Fine Aggregate:
  - 1. Washed natural sand.
  - 2. Gradation:
    - a. Comply with ASTM C33/C33M.
    - b. Represented by smooth granulometric curve within required limits.

3. Free from injurious amounts of organic impurities according to ASTM C40/C40M.

D. Mix:

1. Portland cement, sand, and water.
2. Do not use ferrous aggregate or staining ingredients in grout mixes.

## 2.2 NONSHRINK EPOXY GROUT

A. Description:

1. Pre-proportioned, prepackaged, three-component, nonshrink epoxy grout, 100 percent solids system consisting of epoxy resin, hardener, and blended aggregate.

B. Performance and Design Criteria:

1. Minimum Compressive Strength:

- a. 10,000 psi at seven days.
- b. Comply with ASTM C579.

2. Coefficient of Expansion:

- a.  $30 \times 10^{-6}$  inch per degree F.
- b. Comply with ASTM C531.

3. Minimum Tensile Strength:

- a. 1,800 psi.
- b. Comply with ASTM C307.

C. Product: Provide one of the following or equal:

1. Masterflow 648 CP; by BASF Building Systems.
2. Five Star HP Epoxy Grout; by Five Stars Products, Inc.
3. Sikadur 42 Grout-Pak; by Sika Corp.
4. E3-G Epoxy Grout; by Euclid Chemical Co.

## 2.3 NONSHRINK CEMENTITIOUS GROUT

A. Manufacturers:

1. SikaGrout 212 by Sika Corp.
2. Set Grout by BASF Building Systems.
3. NS Grout by The Euclid Chemical Co.
4. Five Star Grout by Five Star Products, Inc.

B. Description:

1. Pre-mixed and ready-for-use formulation requiring only addition of water.

2. Nonshrink, non-corrosive, nonmetallic, non-gas forming, not containing expansive cement and no chlorides.
3. No shrinkage when tested in conformity with ASTM C827/C827M.

C. Performance and Design Criteria:

1. Certified to maintain initial placement volume or expand after set, and to meet following minimum properties when tested according to ASTM C1107/C1107M for Grades B, C, D and CRD-C621 nonshrink grout:
  - a. Setting Time:
    - 1) Initial: Approximately two hours.
    - 2) Final: Approximately three hours.
    - 3) Comply with ASTM C191.
  - b. Maximum Expansion: 0.10 to 0.40 percent.
  - c. Minimum Compressive Strength:
    - 1) One-Day: 4,000 psi.
    - 2) Seven-Day: 7,000 psi.
    - 3) 28-Day: 10,000 to 10,800 psi.
    - 4) Comply with CRD-C621.

## 2.4 CONCRETE GROUT

- A. Description: Conform to the requirements of Section 03300 “Cast-In-Place Concrete”, except as follows. Proportion with Type II cement, coarse and fine aggregates, water, water reducing admixture, and air entraining agent to produce specified mix performance:
1. Average Strength (ASTM C579): 3500 psi nominal strength.
  2. Maximum Coarse Aggregate Size: 3/8-inch.
  3. Minimum Cement Content: 540 lbs per cubic yard.
  4. Maximum Water to Cement Ratio: 0.45.
  5. Maximum Slump: 5 inches.
- B. Add synthetic reinforcing fibers as specified in Section 033010 “Miscellaneous Cast-in-Place Concrete” to the concrete grout mix at the rate of 1.5 lbs of fibers per cubic yard of grout. Add fibers from manufacturer's pre-measured bags and according to manufacturer's recommendations to ensure complete dispersion of fiber bundles as single monofilaments within the concrete grout.

## 2.5 FORMWORK

- A. As specified in this Section and in Section 033010 “Miscellaneous Cast-in-Place Concrete”.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify areas to receive grout.

### 3.2 PREPARATION

- A. Place grout where indicated or specified over existing concrete and cured concrete which has attained its specified design strength unless otherwise approved by Engineer.
- B. Remove defective concrete, ice, laitance, dirt, oil, grease, form release agents, paints, and other foreign material from concrete surfaces, which may affect the bond or performance of the grout by brushing, hammering, chipping, sand blasting or other similar dry mechanical means until sound and clean concrete surface is achieved. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.
  - 1. Air compressors used to clean surfaces in contact with grout shall be the oil-less type or equipped with an oil trap in the airline to prevent oil from being blown onto the surface.
- C. Roughen concrete lightly, but not to interfere with placement of grout.
- D. Remove foreign materials from metal surfaces in contact with grout.
- E. Align, level, and maintain final positioning of components to be grouted.
- F. Wash concrete surfaces clean and then keep moist for at least 24 hours prior to the placement of nonshrink cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, or flooding the surface or other method acceptable to Engineer. Upon completion of the 24 hour period, remove visible water from the surface prior to grouting.
- G. Nonshrink epoxy grouts do not require saturation of concrete substrate. Do not wet concrete surfaces to receive nonshrink epoxy grout. Completely dry surfaces in contact with epoxy grout before grouting.
- H. Support equipment during alignment and installation of grout by shims, wedges, blocks, or other approved means. Prevent bond of shims, wedges and blocking devices by bond breaking coatings and remove after grouting unless otherwise approved by Engineer. Grout voids created by the removal of shims, wedges, and blocks.

### 3.3 INSTALLATION - GENERAL

- A. Formwork:
  - 1. Construct leakproof forms anchored and shored to withstand grout pressures.
  - 2. Install formwork with clearances to permit proper placement of grout.
  - 3. As specified in Section 033010 "Miscellaneous Cast-in-Place Concrete".



B. Mixing - Portland Cement Grout:

1. Use proportions of two parts sand and one part cement, measured by volume.
2. Prepare grout with water to obtain consistency to permit placing and packing.
3. Mix water and grout in two steps:
  - a. Premix using approximately 2/3 of water.
  - b. After partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing two to three minutes.
4. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
5. Do not add additional water after grout has been mixed.
6. Minimum Compressive Strength (ASTM C 579):
  - a. In 48 hours: 2,400 psi.
  - b. In 28 days 7,000 psi.

C. Placing of Grout:

1. Place grout material quickly and continuously.
2. Do not use pneumatic-pressure or dry-packing methods.
3. Apply grout from one side only to avoid entrapping air.
4. Do not vibrate placed grout mixture or permit placement if area is being vibrated by nearby equipment.
5. Thoroughly compact final installation and eliminate air pockets.
6. Do not remove leveling shims for at least 48 hours after grout has been placed.

D. Curing:

1. Prevent rapid loss of water from grout during first 48 hours [by use of approved membrane curing compound or] by using wet burlap bags, soaker hoses or ponding.
2. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.
3. After grout has attained its initial set, keep damp for minimum three days.

E. Reflect existing underlying expansion joints, partial contraction joints, and construction joints through the grout.

### 3.4 INSTALLATION - CONCRETE GROUT

- A. Inspect slabs finished under Section 03350 "Concrete Finishing" and scheduled to receive concrete grout. Protect and keep the surface clean until placement of concrete grout.
- B. Remove debris and clean the surface by sweeping and vacuuming of all dirt and other foreign materials. Pressure wash the surface. Do not flush debris into tank drain lines.
- C. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout by use of saturated burlap bags, soaker hoses or ponding. Remove excess water just prior to placement of the concrete grout. Place a cement slurry immediately ahead of the concrete grout

so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16 to 1/8-in thick cement paste.

- D. Place concrete grout to final grade using the scrapers of the installed mechanical equipment as a guide for surface elevation and to eliminate high and low spots. Unless specifically approved by the equipment manufacturer, do not use mechanical scraper mechanisms powered by their motors as a finishing machine or screed to push grout.
- E. Provide grout control joints as indicated on Drawings.
- F. Steel trowel finish as specified in Section 033010 "Miscellaneous Cast-In-Place Concrete." Cure the concrete grout as specified for cast-in-place concrete in Section 033010 "Miscellaneous Cast-In-Place Concrete."

### 3.5 INSTALLATION - NONSHRINK EPOXY GROUTS

- A. Mix in accordance with manufacturer's recommendations. Mix full batches only, to maintain proper proportions of resin, hardener and aggregate. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Do not entrain air bubbles by mixing too quickly.
- B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 degrees F or above 90 degrees F.
- C. Place grout rapidly and continuously to avoid cold joints. Place grout in lifts in accordance with manufacturer's recommendations.
- D. Provide forms as specified in Paragraph 3.3A. Place grout into the designated areas and prevent entrapment of air. Fill all spaces and provide full contact between grout and adjoining surfaces. Provide grout holes and vent holes as necessary.
- E. Minimize 'shoulder' length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.
- F. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth top surface of grout in conformity with manufacturer's recommendations.
- G. Epoxy grouts are self-curing and do not require the application of water. Maintain formed grout within its recommended placement temperature range for at least 24 hours after placement, until grout compressive strength reaches 1,000 psi or as recommended by manufacturer, whichever is longer.
- H. Provide grout control joints as indicated on Drawings.

### 3.6 SCHEDULE

#### A. Use particular types of grout as follows:

1. General Purpose Nonshrink Cementitious Grout (CRD-C621 Grade D): Use at locations where nonshrink grout is indicated, except for base plates greater in area than 3-feet wide by 3-feet long.
2. Flowable (precision) Nonshrink Cementitious Grout (CRD-C621 Grade B or C): Use under base plates greater in area than 3-feet wide by 3-feet long. Use at locations indicated to receive flowable (precision) nonshrink grout. Flowable (precision), nonshrink, cementitious grout may be substituted for general purpose nonshrink cementitious grout.
3. Nonshrink Epoxy Grout: Use at locations specifically indicated to receive nonshrink epoxy grout.
4. Cement Grout: Use where indicated.
5. Concrete Grout:
  - a. Use for overlaying the base concrete as indicated.
  - b. Use for concrete grout fill within liquid retaining structures and other locations where specifically indicated.

END OF SECTION 03600

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## SECTION 04220 - CONCRETE 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.
2. Mortar and grout materials.
3. Reinforcement.
4. Masonry-joint reinforcement.
5. Embedded flashing materials.
6. Miscellaneous masonry accessories.

- B. Related Requirements:

1. Section 07273 "Fluid-Applied Membrane Air Barriers" for air barriers applied to surface of unit masonry assemblies.

#### 1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.
- C. Exposed: Weather-exposed side of a constructed wall.

#### 1.4 ACTION SUBMITTALS

- A. Product Data:

1. For each type of product.

- B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

- C. Samples for Initial Selection:
  - 1. Architectural CMUs, in the form of small-scale units.
  - 2. Colored mortar.
  
- D. Samples for Verification: For each type and color of the following:
  - 1. Exposed CMUs.
  - 2. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
  
- B. Material Certificates: For each type and size of the following:
  - 1. Masonry units.
    - a. Include material test reports substantiating compliance with requirements.
    - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
  - 2. Integral water repellent used in CMUs, if not surface treated.
  - 3. Cementitious materials. Include name of manufacturer, brand name, and type.
  - 4. Mortar admixtures.
  - 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  - 6. Grout mixes. Include description of type and proportions of ingredients.
  - 7. Reinforcing bars.
  - 8. Joint reinforcement.
  - 9. Anchors, ties, and metal accessories.
  
- C. 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 in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
  - 2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.
  
- D. 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 in accordance with TMS 402/602.
  
- E. Weather Procedures:
  - 1. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

2. Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.

## 1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  1. Build mockup of typical wall area as indicated on Drawings.
  2. Build mockups for typical exterior wall in sizes approximately 48 inches long by 36 inches high by full thickness, including face and backup wythes and accessories.
    - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
  3. Protect accepted mockups from the elements with weather-resistant membrane.
  4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
    - a. Approval of mockups is also for other material and construction qualities specifically approved by Engineer in writing.
    - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.
  5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## 1.9 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.
  - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.
  - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

## PART 2 - PRODUCTS

### 2.1 SOURCE LIMITATIONS

- 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.
- C. Source Limitations for Integral Water Repellent: Obtain integral water-repellent units from CMU and mortar manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural 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) in accordance with Tables 1 and 2 in TMS 402/602.
  - 2. Determine net-area compressive strength of masonry by testing masonry prisms accordance with ASTM C1314.
- B. Regulatory Requirements: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:
  - 1. TMS 402/602:
    - a. Maintain one copy of the standard in Project field office at all times during construction. Contractor's supervisory personnel are to be thoroughly familiar with this material as it applies to Project.

## 2.3 CONCRETE UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 402/602 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.
- C. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  - 2. Provide square-edged units for outside corners unless otherwise indicated.
- D. Concrete Building Brick: ASTM C55.
  - 1. Density Classification: Normal weight.

E. Building Lintels:

1. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout.
  - a. Knockout blocks will not be acceptable.
- 2.

F. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing in accordance with ASTM E119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

G. Integral Water Repellent: Surface-applied water repellent for exposed units.

1. Description: Liquid polymeric, water-repellent admixture that does not reduce flexural bond strength. Units made with water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing water-repellent manufacturer's mortar additive, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ACM Chemistries.
  - b. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
  - c. Master Builders Solutions, brand of MBCC Group, a Sika company.

## 2.4 CONCRETE MASONRY UNITS

A. Standard CMUs: Load-bearing ASTM C90 and Non-load-bearing ASTM C129.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
2. Density Classification: Normal weight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
4. Exposed Faces: Provide color and texture to match existing CMU.
5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

B. Architectural CMUs: Non-load bearing, ASTM C129.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. York Building Products.
  - b. Nettleton Concrete Inc.
  - c. Best Block

2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
3. Density Classification: Normal weight.
4. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
5. Pattern and Texture:
  - a. Pattern and texture to match existing CMUs.
6. Colors: To match existing CMUs.
7. Special Aggregate: Provide units made with aggregate matching aggregate in Engineer's sample.

## 2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, 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 is not more than 0.1 percent when tested in accordance with ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
- E. Mortar Cement: ASTM C1329/C1329M.
- F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Davis Colors.
    - b. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
    - c. Lanxess Corporation.
- G. Colored Cement Products: Packaged blend made from portland cement and hydrated lime masonry cement or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
  1. Colored Portland Cement-Lime Mix:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Heidelberg Materials.
      - 2) Holcim (US) Inc.

- 3) Lafarge North America Inc.
2. Colored Masonry Cement:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cemex S.A.B. de C.V.
      - 2) Essroc.
      - 3) Holcim (US) Inc.
  3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
  4. Pigments does not exceed 10 percent of portland cement by weight.
  5. Pigments does not exceed 5 percent of masonry cement or mortar cement by weight.
- H. Aggregate for Mortar: ASTM C144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
  3. White-Mortar Aggregates: Natural white sand or crushed white stone.
  4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- I. Aggregate for Grout: ASTM C404.
- J. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
    - b. GCP Applied Technologies Inc.
    - c. BASF Corporation.
- K. Water-Repellent Mortar Admixture: Liquid water-repellent admixture added to mortar, intended for use with CMUs containing integral water repellent from same manufacturer.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ACM Chemistries.
    - b. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
    - c. GCP Applied Technologies Inc.
- L. Water: Potable.

## 2.6 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, 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: Ladder type complying with ASTM A951/A951M.
  - 1. Interior Walls: Hot-dip galvanized carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized carbon steel.
  - 3. Wire Size for Side Rods: 0.187-inch diameter.
  - 4. Wire Size for Cross Rods: 0.187-inch diameter.
  - 5. Spacing of Cross Rods: Not more than 16 inches o.c.
  - 6. Provide in lengths of not less than 10 ft., with prefabricated corner and tee units.

## 2.7 TIES AND ANCHORS

- A. General: Ties and anchors extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
  - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A641/A641M, Class 1 coating.
  - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
  - 3. Stainless Steel Wire: ASTM A580/A580M, Type 304.
  - 4. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
  - 5. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M commercial steel, with ASTM A153/A153M, Class B coating.
  - 6. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
  - 7. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
  - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
- D. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
  - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

## 2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

## 2.9 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. Use portland cement-lime or mortar cement mortar unless otherwise indicated.
  - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
  - 1. For masonry below grade or in contact with earth, use Type S.
  - 2. For reinforced masonry, use Type S.
  - 3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
  - 4. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
  - 1. Pigments does not exceed 10 percent of portland cement by weight.
  - 2. Pigments does not exceed 5 percent of masonry cement or mortar cement by weight.
  - 3. Mix to match Engineer's sample.
  - 4. Application: Use pigmented mortar for exposed mortar joints with the following units:
    - a. Architectural CMUs.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Engineer's sample.
  2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
    - a. Architectural CMUs.
- F. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 402/602 for dimensions of grout spaces and pour height.
  2. Proportion grout in accordance with ASTM C476, 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 in accordance with ASTM C143/C143M.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
  2. Verify that foundations are within tolerances specified.
  3. Verify that reinforcing dowels are properly placed.
  4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- D. Exposed Masonry: Mix units to product uniform blend of colors and textures.
- E. Where existing masonry occurs, match coursing, bonding, color, and texture of existing masonry.

- F. Temperature Control: Perform temperature-sensitive construction procedures while masonry Work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within 10 deg F.
1. 40 to 32 Deg F (4 to 0 Deg C):
    - a. Mortar: Heat mixing water to produce mortar temperature between 40 and 120 deg F.
    - b. Grout: Follow normal masonry procedures.
  2. 32 to 25 Deg F (0 to Minus 4 Deg C):
    - a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F; maintain temperature of mortar on boards above freezing.
    - b. Grout: Heat grout materials to 90 deg F to produce in-place grout temperature of 70 deg F at end of workday.
  3. 25 to 20 Deg F (Minus 4 to 7 Deg C):
    - a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F; maintain temperature of mortar on boards above freezing.
    - b. Grout: Heat grout materials to 90 deg F to produce in-place grout temperature of 70 deg F at end of workday.
    - c. Heat both sides of walls under construction using salamanders or other heat sources.
    - d. Use windbreaks or enclosures when wind is in excess of 15 mph.
  4. 20 Deg F (Minus 7 Deg C) and Below:
    - a. Mortar: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F.
    - b. Grout: Heat grout materials to 90 deg F to produce in-place grout temperature of 70 deg F at end of workday.
    - c. Masonry Units: Heat masonry units so that they are above 20 deg F at time of laying.
    - d. Provide enclosure and auxiliary heat to maintain an air temperature of at least 40 deg F for 24 hours after laying units.
  5. Do not heat water for mortar and grout to above 160 deg F.
- G. Masonry Protection: Protect completed masonry and masonry not being worked on in the following manner. Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry, temperature ranges apply to anticipated minimum night temperatures.
1. 40 to 32 Deg F (4 to 0 Deg C): Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.
  2. 32 to 25 Deg F (0 to Minus 4 Deg C): Completely cover masonry with weather-resistive membrane for at least 24 hours.



3. 25 to 20 Deg F (Minus 4 to 7 Deg C): Completely cover masonry with weather-resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.
4. 20 Deg F (Minus 7 Deg C) and Below: Except as otherwise indicated, maintain masonry temperature above 32 deg F (0 deg C) for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps or other methods proven to be satisfactory. For grouted masonry, maintain heated enclosure to 40 deg F for 48 hours.

### 3.3 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 ft., 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 ft., 1/4 inch in 20 ft., or 1/2 inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., 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 ft., 1/4 inch in 20 ft., or 1/2 inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., 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 ft. 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.

#### 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.

### 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by 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 brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow 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.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Where applicable, set masonry trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
  - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
  - 2. Wet joint surfaces thoroughly before applying mortar.
  - 3. Rake out mortar joints for pointing with sealant.

- D. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.
- E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- G. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

### 3.6 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. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

### 3.7 CONTROL JOINTS

- A. General: Install control joint materials in CMUs as masonry progresses. Do not allow materials to span control joints without provision to allow for in-plane wall or partition movement.
- B. Locate control joints. See Drawings.
- C. Form control joints in CMUs as follows:
  - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
  - 2. Install preformed control joint gaskets designed to fit standard sash block.
  - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
  - 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

### 3.8 LINTELS

- A. Install lintels over openings as indicated.
- B. Provide concrete or formed-in-place masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.
- C. Install loose steel over openings, as follows:
  - 1. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.
- D. Lintels at Fire-Rated Openings: Provide fire-rated masonry required or steel lintels with applied fireproofing in thickness required to maintain fire rating of wall or partition rating.

### 3.9 FLASHING

- A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.
- B. Install flashing as follows unless otherwise indicated:
  - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
  - 2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
  - 3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07920 "Joint Sealants" for application indicated.
  - 4. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07920 "Joint Sealants" for application indicated.
  - 5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
  - 6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

### 3.10 REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 402/602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in TMS 402/602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches.

### 3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements is done at Contractor's expense.
- B. Inspections: Level 2 special inspections to comply with the International Building Code.
  - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
  - 2. Place grout only after inspectors have verified compliance of grout spaces, grades, sizes, and locations of reinforcement.
  - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

- G. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.
- I. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at 28 days.
- J. Fire-Resistance Rated Construction: Where applicable, inspect fire-rated CMU construction to determine compliance with construction documents per building code compliance.

### 3.12 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

### 3.13 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as Work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Engineer's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid-strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 08-04A.

### 3.14 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
  1. Crush masonry waste to less than 4 inches in each dimension.
  2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste. Fill material is specified in Section 02300 "Earth Moving."
  3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04220

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## SECTION 05051 - POST-INSTALLED ANCHORS AND REINFORCING BARS

### 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. Post-installed adhesive and expansion anchors for concrete substrates.
- 2. Post-installed reinforcing bar dowels using adhesive anchoring system.

- B. Related Requirements:

- 1. Section 03303 "Miscellaneous Cast-In-Place Concrete" and related Sections for concrete, reinforcement, and accessories.
- 2. Various Sections in Division 05 related to metals.
- 3. Various Sections in Divisions 40 and 46 related to process mechanical equipment.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Review methods and procedures related to post-installed anchors including, but not limited to, the following:
  - a. Verify specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
  - b. Materials, material application, sequencing, tolerances, and required clearances.
  - c. Temperature, humidity & moisture limitations for adhesive anchoring system.
  - d. Manufacturer's instructions for installation of expansion anchors and adhesive anchoring system.
  - e. Quality-control program.
  - f. Coordination with building occupants.
- 2. Attendees:
  - a. Owner.
  - b. Resident Engineer.
  - c. Contractor.
  - d. Manufacturer Representative.

#### 1.4 ACTION SUBMITTALS

##### A. Post-Installed Expansion Anchors:

1. Design Data: Submit manufacturer's specifications and data including recommended design values and physical characteristics for expansion anchors.
2. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, materials and finishes for post-installed expansion anchors installed into cracked concrete.
3. Installation Procedures: Submit procedures stating product proposed for use, and complete installation method.

##### B. Post-Installed Adhesive Anchoring System:

1. Design Data: Submit manufacturer's specifications and data including recommended design values and physical characteristics, including temperature, humidity, and moisture limitations for adhesive anchoring system.
2. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, materials and finishes for post-installed adhesive anchoring system installed into cracked concrete.
3. Installation Procedures: Submit procedures stating method of drilling, product proposed for use, and complete installation method.

#### 1.5 INFORMATIONAL SUBMITTALS

##### A. Installation procedure: Submit installation procedure for post-installed adhesive anchoring system; including method of drilling.

##### B. Certificates:

1. Installer Qualifications for Adhesive Anchoring System: Submit installer and testing agency qualifications as stated in following Paragraph of this Article.
2. Submit current International Code Council (ICC) Evaluation Service Reports (ESR) for expansion anchors and adhesive anchoring system, for installation into cracked concrete, as applicable, indicating conformance with current ICC Evaluation Service (ICC-ES) Acceptance Criteria.

##### C. Qualification Data:

1. Installer: Indicate manufacturer's training date and a list of personnel trained on installation of adhesive anchoring system.

##### D. Evaluation Reports: From ICC-ES for expansion anchors and adhesive anchoring system, for installation of post-installed anchors into cracked concrete, as applicable, indicating conformance with current ICC ES Acceptance Criteria.

## 1.6 QUALITY ASSURANCE

- A. General: Coordinate with the work of other Sections, field verifying dimensions and work of other trades adjoining items of work before installing items specified in this Section.
- B. Adhesive Anchoring System:
  - 1. Installer Training: Conduct thorough training by the manufacturer or the manufacturer's representative. Training shall consist of the complete installation process for post-installed anchors and reinforcing bar dowels, including but not limited to:
    - a. Tool selection.
    - b. Hole drilling procedure.
    - c. Hole preparation and cleaning techniques.
    - d. Adhesive injection technique and dispenser training and maintenance.
    - e. Anchor preparation and installation.
    - f. Reinforcing bar dowels preparation and installation.
    - g. Proof loading and torquing.
    - h. Temperature, humidity, and moisture limitations.
    - i. Working time limitations.
    - j. Setting time.
  - 2. Include training for anchors and reinforcing bar dowels installed horizontally or upwardly inclined to support sustained tension loads. Install horizontally or upwardly inclined anchors and reinforcing bar dowels by personnel certified by an applicable certification program. Certification shall include written and performance tests in accordance with the ACI/CRSI Adhesive Anchor Installer Certification program, or equivalent.
  - 3. Manufacturer's Certificate of Proper Installation: Submit upon completion of work, for the post-installed anchors and reinforcing bar dowels, including non-production and production anchors and reinforcing bar dowels.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.
- B. Handle materials with cranes or derricks. Do not dump material off transportation vehicles or handle in ways that will cause damage.
- C. Store materials elevated above grade and block up so they will not become bent or otherwise damaged.
- D. Repair items that have become damage or corroded to satisfaction of the Engineer prior to incorporating them into the work.

## PART 2 - PRODUCTS

### 2.1 EXPANSION ANCHORS

- A. Fastening to Concrete Substrate: Zinc plated carbon steel wedge type anchors, complete with zinc plated nuts and washers, unless otherwise noted.
- B. Submerged or Weather Exposed Substrates: ASTM A276 Type 316 stainless steel wedge type anchors, complete with Type 316 stainless steel nuts and washers, unless otherwise noted.
- C. Meet ICC ES AC01 or ICC ES AC193.
- D. Length: When length or anchor embedment is not indicated, provide length sufficient to place the wedge and expansion cone portion of the anchor at least 1 inch behind concrete reinforcing steel.
- E. Basis-of-Design:
  - 1. Anchorage designs indicated are based on Hilti, Kwik-Bolt TZ, unless otherwise noted.
  - 2. Acceptable Anchors: Hilti Kwik-Bolt TZ; Simpson Strong-Tie Strong Bolt 2 Wedge Anchor; DeWalt Power-Stud+ SD1 [DeWalt Power-Stud+ SD6 for stainless steel]; or equal.

### 2.2 ADHESIVE ANCHORING SYSTEM

- A. Fastening to Concrete Substrate: Manufactured system consisting of post installed threaded rods, nuts, washers, other anchoring hardware, and chemical dispenser for installation in hammer drilled holes.
  - 1. Anchors: Meet ICC ES AC308.
  - 2. Injection Adhesive: Two-component epoxy system consisting of a hardener and a resin, furnished in pre-measured side-by-side cartridges which keep both components separate.
    - a. Adhesive: Made for use in contact with potable water.
  - 3. Adhesive Cartridge: Side-by-side design to accept a static mixing nozzle which thoroughly blends both components and allows injection directly into a drilled hole.
  - 4. Anchor: or Type 316 stainless steel as indicated consisting of an all-thread anchor rod with nut and washer, of matching material to anchor rod.
    - a. Basis-of-Design:
      - 1) Anchorage designs indicated are based on Hilti HIT- RE 500 V3, unless otherwise noted.
      - 2) Acceptable Manufacturers: Hilti HIT- RE 500 V3; Simpson Strong Tie SET-XP; ITW Ramset Red Head Epon G5; or equal.

5. Reinforcing Bar Dowels: Reinforcing bar, per Section 03303.
  - a. Basis-of-Design:
    - 1) Anchorage designs indicated are based on Hilti HIT- RE 500 V3, unless otherwise noted.
    - 2) Acceptable Manufacturers: Hilti HIT- RE 500 V3; Simpson Strong Tie SETET-XP; ITW Ramset Red Head Epcon G5; or equal.

## 2.3 PERFORMANCE REQUIREMENTS

- A. Performance: design anchors and reinforcing bar dowel anchorage for all anticipated loads and load combinations per ASCE/SEI 7 including omega-naught ( $\Omega_o$ ) factors as applicable.
- B. Seismic Performance: post-installed concrete anchors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  1. Term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
  2. Component Importance Factor is ( $I_p$ ):
    - a. Component Importance Factor ( $I_p$ ) = 1.5 for.
    - b. Component Importance Factor ( $I_p$ ) = 1.0 for all other components.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
  1. Install anchoring system in strict compliance with manufacturer's published installation instructions and approved Shop Drawings. Comply with recommended surface preparation, temperature, and moisture of substrate and ambient conditions.
  2. Coordinate installation with Special Inspector.
  3. Use drill bit of correct diameter and drill to required depth using rotary impact type hammer drills with carbide-tipped bits.
  4. Drill holes perpendicular to concrete surface, unless otherwise indicated.
  5. Use oil free compressed air to blast out loose particles and dust from drilled holes.
- B. Expansion anchors:
  1. Check expansion anchors for tightness a minimum of 24 hours after initial installation.
- C. Adhesive anchoring system:
  1. Perform installation only by personnel trained in anchor installation and having certification required in PART 1 - GENERAL.

2. Inject adhesive and install anchors and reinforcing bar dowels that are clean and free of dirt, oil, grease, ice or other deleterious material which would reduce bond.

END OF SECTION 05051

## SECTION 05502 - METAL FABRICATIONS

### 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. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Miscellaneous items fabricated from steel aluminum or stainless steel.
4. Steel pipe pieces for sleeves.
5. Castings.
6. Loose bearing and leveling plates for applications where they are not specified in other Sections.
7. Delegated design.

- B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

- C. Related Requirements:

1. Section 03303 "Miscellaneous Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 03600 "Grouting" for non-shrink grout.
3. Section 05051 "Post-Installed Anchors and Reinforcing Bars" for anchors in various substrates.

#### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves,

concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

#### 1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.

B. Samples:

1. Submit samples as requested by the Engineer during construction.

C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Miscellaneous steel items.
4. Miscellaneous stainless-steel items.

#### 1.5 DELEGATED-DESIGN SUBMITTALS

A. For framing, supports and platforms, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. See Section 01400 “Quality Requirements” for additional delegated design requirements.

B. Qualifications Statement: Submit qualifications for licensed professional.

#### 1.6 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by aluminum, steel and stainless-steel manufacturers, certifying that products furnished comply with requirements.

B. Welding certificates.

1. Certify that welders have been qualified under AWS, within previous 12 months, to perform welds required under this Section.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.



## 1.7 QUALITY ASSURANCE

- A. Delegated Design Engineer: Licensed professional engineer experienced in design of specified Work and licensed in the State of Project location.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless steel."
- D. Evaluation Reports: Post-installed concrete anchors, from ICC-ES for expansion anchors and adhesive anchor system, for installation into cracked concrete, as applicable, indicating conformance with current ICC ES Acceptance Criteria.

## 1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01400 "Quality Requirements," to design framing, supports and platforms.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

### 2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Wide Flange Shapes: ASTM A992.
- C. Steel Other Shapes, Plates, Shapes, and Bars: ASTM A36/A36M.

- D. Stainless steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 316 Type 316L for welded components.
- E. Stainless steel Bars and Shapes: ASTM A276, Type 316 Type 316L for welded components.
- F. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- G. Rolled-Stainless Steel Floor Plate: ASTM A793.
- H. Steel Tubing: ASTM A500/A500M, Grade B cold-formed steel tubing.
- I. Steel Pipe: ASTM A53/A53M, Type S Grade B Standard Weight (Schedule 40) unless otherwise indicated.
- J. Zinc-Coated Steel Wire Rope: ASTM A741.
  - 1. Wire-Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- K. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
  - 2. Material: Stainless steel 316
- L. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- M. Aluminum Extruded Pipe: ASTM B429, Alloy 6063 T6 and Alloy 6061 T6 as indicated.
- N. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- O. Aluminum Extrusions: ASTM B221, Alloy 6061 T6.
- P. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
- Q. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.
- R. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).
- S. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- T. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.
- U. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).
- V. Gray Iron Castings: ASTM A48, Class 35.

- W. Ductile Iron Castings: ASTM A536, Grade 65-45-12.
- X. Stainless steel Bolts: ASTM F593, Type 316.
- Y. Stainless steel Nuts: ASTM F594, Type 316.
- Z. Carbon Steel Bolts and Studs: ASTM A307, Grade A (hot dip galvanized nuts and washers where noted)
- AA. High Strength Steel Bolts, Nuts and washers: ASTM F3125, Grade A325 (mechanically galvanized per ASTM B695, Class 50, where noted).
  - 1. Elevated Temperature Exposure: Type I.
  - 2. General Application: Type I or Type II.
- BB. Galvanizing: ASTM A123, Zn w/0.05 percent minimum Ni.
- CC. Galvanizing, hardware: ASTM A153, Zn w/0.05 percent minimum Ni.
- DD. Galvanizing, anchor bolts: ASTM F2329, Zn w/0.05 percent minimum Ni.
- EE. Welding electrodes, steel: AWS A5.1 E70xx.

## 2.3 FASTENERS

- A. Unless otherwise noted, provide steel machine bolts for the connection of carbon steel or iron; galvanized steel or stainless-steel machine bolts for the connection of galvanized steel or iron; and stainless steel machine bolts for the connection of aluminum or stainless-steel.
- B. General: Unless otherwise indicated, provide [**Type 316**] stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless steel fasteners for fastening aluminum.
  - 2. Provide stainless steel fasteners for fastening stainless steel.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- D. Mechanically Galvanized Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM F3125, Grade A325, Type 3; with hex nuts, ASTM A563, Grade C3; and, where indicated, flat washers.
- E. Stainless steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 2.

- F. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
  - 1. Provide standard headed bolts with heavy hex nuts and Grade A washers.
  - 2. Where galvanized anchor bolts are indicated or specified, provide standard headed bolts with heavy hex nuts and Grade A washers, galvanize in accordance with ASTM F2329.
- G. Automatic End Welded Headed Anchor Studs and Flux Ended Studs: Cold drawn steel, ASTM A108, Grades C-1010 through C-1020.
  - 1. Basis-of-Design - Headed Anchor Studs as Manufactured by Nelson or equal: H4L Headed Concrete Anchors.
- H. Machine bolts and nuts conforming to Federal Specification FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers and related appurtenances shall be Type 316 stainless steel.
- I. Toggle Bolts: shall be Hilti, Toggler Bolt or equal.
- J. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.
- K. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- L. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts

## 2.4 MISCELLANEOUS STEEL

- A. Miscellaneous Steel Work: Formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Drill or punch holes. Smooth edges without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.
- B. Connections and Accessories: Sufficient strength to safely withstand the stresses and strains to which they will be subjected. Close fitting exposed joints and jointed where least conspicuous. Conceal thread on threaded connections where practical. Provide continuous welds or intermittent welds on welded connections as specified or shown. Dress face of welds flush and smooth. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous Steel Items: Beams, angles, lintels, metal stairs detailed on the Drawings, support brackets, base plates for other than structural steel or equipment, closure angles, bridge crane

rails, monorail hoist beams, holddown straps and lugs, door frames, splice plates, subframing at roof openings and any other miscellaneous steel indicated and not otherwise specified.

- D. Steel pipe pieces for sleeves, lifting attachments and other functions: Schedule 40 pipe unless otherwise indicated. Wall and floor sleeves, of steel pipe: Provide welded circumferential steel waterstops at mid-length.
- E. Steel Finish Work: Thoroughly cleaned, by effective means, of loose mill scale, rust and foreign matter. Provide one shop coat of primer compatible with finish coat after fabrication but before shipment. Omit paint within 3 inches of proposed field welds. Apply paint to dry surfaces and be thoroughly and evenly spread and well worked into joints and other open spaces.
- F. Galvanizing, where required: Use hot-dip zinc process after fabrication, coating not less than 2 oz/sq.ft. of surface.

## 2.5 MISCELLANEOUS STAINLESS-STEEL

- A. Miscellaneous Stainless-Steel Work: Formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Drill or punch holes. Smooth edges without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.
- B. Connections and accessories: Sufficient strength to safely withstand the stresses and strains to which they will be subjected. Close fitting exposed joints jointed where least conspicuous. Conceal threads on threaded connections where practical. Provide continuous welds or intermittent welds on welded connections as specified or shown. Dress face of welds flush and smooth. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Beams, angles, bar racks, and other miscellaneous stainless steel.

## 2.6 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with ASTM A780 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

## 2.7 CASTINGS:

- A. General: Good quality, strong, tough, even-grained, smooth, free from scale, lumps, blisters, sand holes, and other defects. Thoroughly clean castings to remove foreign matter, and deleterious films. Castings will be subjected to a hammer inspection in the field by the Engineer. Damaged castings may be rejected and replaced at no cost to the Owner.
- B. Matching Surfaces: Machine to a true plane surface allowing contact surfaces to seat without rocking. Provide allowances in patterns so specified thickness is not reduced to obtain finished surfaces. Castings will not be acceptable if actual weight is less than 95 percent of theoretical weight computed from dimensions. Provide facilities for weighing castings in the presence of the Engineer.

## 2.8 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated, coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/4 by 1 inch, with a minimum 6 inch embedment and 1 1/2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.9 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - 1. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.

## 2.10 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
  - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize and prime exterior miscellaneous steel trim.

## 2.11 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Material per Drawings.

## 2.12 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

## 2.13 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## 2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products. Limit maximum nickel (Ni) content of galvanizing zinc to 0.05%.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean [railings] of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer unless indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." requirements indicated below:
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 3. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.



## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Install all items except those to be embedded in concrete or other masonry which shall be installed under Division 03 and Division 04 respectively. Install items to be attached to concrete or masonry after such work is completed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.
1. Touch up abrasions in the shop primer immediately after erection. Paint areas left unprimed for welding after welding.
  2. Clean and repair, after installation, zinc coating which has been burned by welding, abraded, or otherwise damaged. Thoroughly clean damaged area and remove all traces of welding flux and loose or cracked zinc coating prior to painting. Paint the cleaned area per the requirements of ASTM A780.
  3. Install specialty products in accordance with the manufacturer's recommendations.
  4. Weld headed anchor studs in accordance with manufacturer's recommendations.
  5. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
  6. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
  7. Field Welding: Comply with the following requirements:
  8. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  9. Obtain fusion without undercut or overlap.
  10. Remove welding flux immediately.
  11. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
  12. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
  13. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
  14. Corrosion Protection: Coat concealed surfaces of aluminum and steel that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
    - a. Steel Contacting Exposed Concrete: Apply heavy bitumastic troweling mastic.

### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

- B. Anchor supports for framing and supports securely to, and rigidly brace from, building structure.
- C. Support steel girders on concrete, or steel pipe columns. Secure girders with anchor bolts embedded in concrete or with bolts through top plates of pipe columns.
  - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
  - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

### 3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION 05502

## SECTION 06100 - ROUGH CARPENTRY

### 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. Miscellaneous lumber: Wood blocking, cants, and nailers.
- B. Related Requirements:
  - 1. Section 05502 "Metal Fabrications" for secondary framing.

#### 1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. Lumber grading agencies, and abbreviations used to reference them, include the following:
  - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
  - 2. NLGA: National Lumber Grades Authority.
  - 3. SPIB: The Southern Pine Inspection Bureau.
  - 4. WCLIB: West Coast Lumber Inspection Bureau.
  - 5. WWPA: Western Wood Products Association.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include

physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

## 1.5 INFORMATIONAL SUBMITTALS

### A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- ### A.
- Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS

- ### A.
- Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
4. Dress lumber, S4S, unless otherwise indicated.

### B. Maximum Moisture Content:

1. Boards: 15 percent.
2. Dimension Lumber: 19 percent for 2-inch nominal thickness or less; no limit for more than 2-inch nominal thickness unless otherwise indicated.

## 2.2 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Cants.
- B. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

## 2.3 FASTENERS

- A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.
  - 2. For redwood, use hot-dip galvanized-steel fasteners.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

- D. Do not splice structural members between supports unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- G. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
  - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
  - 3. ICC-ES evaluation report for fastener.
- J. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.
- K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

### 3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

- C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.
- D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06100

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## SECTION 07210 - THERMAL INSULATION

### 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. Polyisocyanurate foam-plastic board.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
  - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
  - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
  - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

### PART 2 - PRODUCTS

#### 2.1 POLYISOCYANURATE FOAM-PLASTIC BOARD

- A. Polyisocyanurate Board, Foil Faced: ASTM C1289, foil faced, Type I, Class 1 or 2.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Carlisle Coatings & Waterproofing Inc.
  - b. Johns Manville; a Berkshire Hathaway company.
  - c. The Dow Chemical Company.
2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

## 2.2 INSULATION FASTENERS

- A. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AGM Industries, Inc.
    - b. Gemco.

## 2.3 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
  1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
- C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

### 3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.

- 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. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

### 3.3 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07210

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## SECTION 07273 - FLUID-APPLIED MEMBRANE AIR BARRIERS

### 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. Vapor-retarding, fluid-applied air barriers.
  - 2. Vapor-permeable, fluid-applied air barriers.
- B. Related Requirements:
  - 1. Section 07210 "Thermal Insulation" for rigid insulation.

#### 1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

- B. Shop Drawings: For air-barrier assemblies.
  - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
  - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
  - 3. Include details of interfaces with other materials that form part of air barrier.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Field quality-control reports.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
  - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

#### 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
  - 1. Protect substrates from environmental conditions that affect air-barrier performance.
  - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

### 2.3 HIGH-BUILD AIR BARRIERS, VAPOR RETARDING

- A. High-Build, Vapor-Retarding Air Barrier: Modified bituminous membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.

- 1. Modified Bituminous Type:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Carlisle Coatings & Waterproofing Inc.
- 2) Tremco Incorporated.
- 3) W. R. Meadows, Inc.

- 2. Physical and Performance Properties:

- a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
- b. Vapor Permeance: Maximum 0.1 perm; ASTM E96/E96M, Desiccant Method.
- c. Ultimate Elongation: Minimum 500 percent; ASTM D412, Die C.
- d. Adhesion to Substrate: Minimum 30 lbf/sq. in. when tested according to ASTM D4541.
- e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- f. UV Resistance: Can be exposed to sunlight for 30 days according to manufacturer's written instructions.

## 2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.
- D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Pecora Corporation.
    - b. The Dow Chemical Company.
    - c. Tremco Incorporated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
  - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
  - 3. Verify that substrates are visibly dry and free of moisture.
  - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.



- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

### 3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
  - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
  - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
  - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
  - 1. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, transition strip.
- H. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- I. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

#### 3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
  - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  - 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
  - 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.
  - 1. Vapor-Retarding, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils, applied in two equal coats.
- C. Do not cover air barrier until it has been tested and inspected by testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

### 3.5 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
  - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
  - 2. Air-barrier dry film thickness.
  - 3. Continuous structural support of air-barrier system has been provided.
  - 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
  - 5. Site conditions for application temperature and dryness of substrates have been maintained.
  - 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
  - 7. Surfaces have been primed, if applicable.
  - 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
  - 9. Termination mastic has been applied on cut edges.
  - 10. Strips and transition strips have been firmly adhered to substrate.
  - 11. Compatible materials have been used.
  - 12. Transitions at changes in direction and structural support at gaps have been provided.
  - 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
  - 14. All penetrations have been sealed.
- D. Tests: As determined by testing agency from among the following tests:
  - 1. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.
- E. Air barriers will be considered defective if they do not pass tests and inspections.
  - 1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
  - 2. Remove and replace deficient air-barrier components for retesting as specified above.
- F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- G. Prepare test and inspection reports.

### 3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
  - 1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
  - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 07273

## SECTION 07421 - FORMED METAL WALL PANELS

### 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 liner panels.

- B. Related Sections:

- 1. Section 07422 "Metal Plate Wall Panels" for solid metal plate wall panels.
  - 2. Section 07423 "Insulated Metal Wall Panels" for foamed-in-place, laminated and honeycomb insulated metal wall panels.
  - 3. Section 07424 "Metal Composite Material Wall Panels" for metal-faced composite wall panels.
  - 4. Section 07429 "Soffit Panels" for metal panels used in horizontal soffit applications.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Meet with Owner, Engineer, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
  - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
  - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
  - 7. Review temporary protection requirements for metal panel assembly during and after installation.
  - 8. Review of procedures for repair of metal panels damaged after installation.

9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

#### 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 each type of panel and accessory.
- B. Shop Drawings:
  1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
  2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.
  1. Include Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
  1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockup of typical metal panel assembly as shown on Drawings, including supports, attachments, and accessories.
  - 2. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration according to AAMA 501.2.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer 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.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal 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. Retain strippable protective covering on metal panels during installation.

## 1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

## 1.10 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which 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 Delta E units when tested according to ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Other Design Loads: As indicated on Drawings.
  - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).



- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- 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 (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

## 2.2 METAL LINER PANELS

- A. Provide factory-formed metal liner panels designed for interior side walls and field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for a complete installation.
- B. Metal Liner Panels: Solid panels formed with a flat pan between panel edges; with a flush joint between panels.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. MBCI
    - b. Centria
    - c. Bridger Steel
  - 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
    - a. Nominal Thickness: 0.028 inch (0.71 mm).
    - b. Exterior Finish: Three-coat fluoropolymer.
    - c. Color: As selected by Engineer from manufacturer's full range.
  - 3. Panel Coverage: 36 inches (914 mm).
  - 4. Seam Profile: Tapered.

5. Seam Height: 1.5 inches (38 mm).
6. Acoustical Performance: Where sound-absorption requirement is indicated, fabricate interior liner panels with 1/8-inch- (3-mm-) diameter holes uniformly spaced approximately 1000 holes/sq. ft. (10 750 holes/sq. m).
  - a. NRC of not less than 1.00 when tested according to ASTM C423.

## 2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
  1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal 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- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
  1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
  2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
  3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

## 2.4 FABRICATION

- 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. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
  - 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.
  - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  - 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
  - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

## 2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- B. 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 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.
- C. Steel Panels and Accessories:
  - 1. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
  - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
  - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
    - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

### 3.3 INSTALLATION

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels.
  2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
  3. Install screw fasteners in predrilled holes.
  4. Locate and space fastenings in uniform vertical and horizontal alignment.
  5. Install flashing and trim as metal panel work proceeds.
  6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
  2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
  3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
  5. Flash and seal panels with weather closures at perimeter of all openings.
- E. Watertight Installation:
1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
  2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.

3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Metal Liner Panels: Install panels on interior side of girts with flush appearance on the inside.
- G. Accessory Installation: 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 panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- H. 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 as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without 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 achieve waterproof performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

### 3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07421

## SECTION 07423 - INSULATED METAL WALL PANELS

### 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. Foamed-insulation-core metal wall panels.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Meet with Owner, Engineer, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
  - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
  - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
  - 7. Review temporary protection requirements for metal panel assembly during and after installation.
  - 8. Review procedures for repair of metal panels damaged after installation.
  - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

#### 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 each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  1. Build mockup of typical metal panel assembly as shown on Drawings, including corner, supports, attachments, and accessories.
  2. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration according to AAMA 501.2.



3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer 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.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal 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. Retain strippable protective covering on metal panels during installation.

#### 1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

#### 1.10 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### 1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which 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 D2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E72:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Other Design Loads: As indicated on Drawings.
  - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
  - 4. .
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- 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 (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E119.
2. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
3. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
4. Potential Heat: Acceptable level when tested according to NFPA 259.
5. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E84.

## 2.2 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
1. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
    - a. Closed-Cell Content: 90 percent when tested according to ASTM D6226.
    - b. Density: 2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m) when tested according to ASTM D1622.
    - c. Compressive Strength: Minimum 20 psi (140 kPa) when tested according to ASTM D1621.
    - d. Shear Strength: 26 psi (179 kPa) when tested according to ASTM C273/C273M.
- B. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CENTRIA, a Nucor Brand.
    - b. Kingspan Insulated Panels, Inc.
    - c. MBCI; Cornerstone Building Brands.
  2. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
    - a. Nominal Thickness: 0.034 inch (0.86 mm).
    - b. Exterior Finish: Three-coat fluoropolymer.

- 1) Color: As selected by Engineer from manufacturer's full range.
- c. Interior Finish: Siliconized polyester.
- 1) Color: As selected by Engineer from manufacturer's full range.
3. Backer Board: On back side of exterior facing.
  4. Snap-on Batten: Same material, finish, and color as exterior facings of wall panels.
  5. Panel Coverage: 36 inches (914 mm) nominal.
  6. Panel Thickness: 2.0 inches (51 mm).
  7. Thermal-Resistance Value (R-Value): **R-5.7** according to ASTM C1363.

### 2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal 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- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

## 2.4 FABRICATION

- A. General: 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. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
  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.
  2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
  5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

## 2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- B. 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 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.
- C. Aluminum Panels and Accessories:
  - 1. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
  - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
  - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
    - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

### 3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise

indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 07920 "Joint Sealants."

### 3.4 INSULATED METAL WALL PANEL INSTALLATION

A. General: 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 for weather seal.

1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.

4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
  6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
  7. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.
- B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.
1. Install clips to supports with self-tapping fasteners.
- C. Accessory Installation: 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 panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- D. 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 are permanently watertight.
1. Install exposed flashing and trim that is without 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 achieve waterproof performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- C. Metal wall panels will be considered defective if they do not pass test and inspections.



- D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- E. Prepare test and inspection reports.

### 3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07423

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## SECTION 07710 - ROOF 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. Roof-edge drainage systems.
- B. Preinstallation Conference: Conduct conference at Project site.
  - 1. Meet with Owner, Engineer, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
  - 2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
  - 3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

#### 1.3 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. Samples for Verification:
  - 1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
  - 2. Include roof-edge drainage systems made from 12-inch (300-mm) lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of roof specialty.

- C. Sample Warranty: For manufacturer's special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

#### 1.8 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### 1.9 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. FM Approvals' Listing: Manufacture and install roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.
- C. SPRI Wind Design Standard: Manufacture and install roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:
  - 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

### 2.2 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ATAS International, Inc.
  - 2. Castle Metal Products.
  - 3. OMG Roofing Products; a Division of OMG, Inc.
  - 4. SAF (Southern Aluminum Finishing Company, Inc.).
- B. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
  - 1. Formed Aluminum: 0.063 inch (1.60 mm) thick.
- C. Aluminum Finish: Three-coat fluoropolymer.
  - 1. Color: As selected by Engineer from manufacturer's full range.

## 2.3 MATERIALS

- A. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

## 2.4 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

- 1. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

## 2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: 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.
- D. Coil-Coated Aluminum Sheet Finishes:
  - 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    - a. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
  - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
  - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
  - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
  - 4. Torch cutting of roof specialties is not permitted.
  - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - 1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
- C. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).
- D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

### 3.3 INSTALLATION OF ROOF-EDGE DRAINAGE-SYSTEM

- A. Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.
  - 1. Provide elbows at base of downspouts at grade to direct water away from building.

### 3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07710



## SECTION 07920 - JOINT SEALANTS

### 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. Silicone joint sealants.
  - 2. Nonstaining silicone joint sealants.
  - 3. Urethane joint sealants.
  - 4. Immersible joint sealants.
  - 5. Butyl joint sealants.
  - 6. Latex joint sealants.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.

- B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.
- C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- D. Field-Adhesion-Test Reports: For each sealant application tested.
- E. Sample Warranties: For special warranties.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
  - 1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

## 1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
  - 1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
  - 2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
  - 3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with masonry substrates.
  - 4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
  - 5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  - 6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
  - 7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Engineer.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Engineer seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
  - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
    - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

#### 1.8 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  2. When joint substrates are wet.
  3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

#### 1.9 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: Five years from date of Substantial Completion.

- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  - 2. Disintegration of joint substrates from causes exceeding design specifications.
  - 3. Mechanical damage caused by individuals, tools, or other outside agents.
  - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Engineer from manufacturer's full range.

### 2.2 SILICONE JOINT SEALANTS

- A. Silicone, Acid Curing, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bostik; Arkema.
    - b. Pecora Corporation.
    - c. Sika Corporation - Building Components.

### 2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Pecora Corporation.
    - b. Sika Corporation - Building Components.
    - c. Bostik; Arkema.

## 2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bostik; Arkema.
    - b. Pecora Corporation.
    - c. Sika Corporation - Building Components.
- B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Pecora Corporation.
    - b. Bostik; Arkema.
    - c. Sika Corporation – Building Components
- C. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Pecora Corporation.
    - b. Bostik; Arkema.
    - c. Sika Corporation – Building Components

## 2.5 IMMERSIBLE JOINT SEALANTS

- A. Immersible Joint Sealants. Suitable for immersion in liquids; ASTM C1247, Class 1; tested in deionized water unless otherwise indicated
- B. Urethane, Immersible, S, P, 50, T, NT, I: Immersible, single-component, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 50, Uses T, NT, and I.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Pecora Corporation.
    - b. Bostik; Arkema.
    - c. Sika Corporation – Building Components.

## 2.6 BUTYL JOINT SEALANTS

### A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Bostik; Arkema.
  - b. Pecora Corporation.
  - c. Sika Corporation - Building Components.

## 2.7 LATEX JOINT SEALANTS

### A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Pecora Corporation.
  - b. Bostik; Arkema.
  - c. Sika Corporation – Building Components.

## 2.8 JOINT-SEALANT BACKING

### A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Adfast.
  - b. Alcot Plastics Ltd.
  - c. Construction Foam Products; a division of Nomaco, Inc.

### B. Cylindrical Sealant Backings: ASTM C1330, Type O (open-cell material), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

### C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 2.9 MISCELLANEOUS MATERIALS

### A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

### B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or

harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or

by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.
  - 4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C1193.
  - 5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C1193.
    - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.



### 3.4 FIELD QUALITY CONTROL

#### A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
  - a. Perform 5 tests for the first 500 feet of joint length for each kind of sealant and joint substrate.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
  - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
  - a. Whether sealants filled joint cavities and are free of voids.
  - b. Whether sealant dimensions and configurations comply with specified requirements.
  - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

#### B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.5 CLEANING

#### A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### 3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
  - 1. Joint Locations:
    - a. Joints between different materials listed above.
    - b. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Urethane, M, P, 50, T, NT.
  - 3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces .
  - 1. Joint Locations:
    - a. Construction joints in cast-in-place concrete.
    - b. Control and expansion joints in unit masonry.
    - c. Joints between metal panels.
    - d. Joints between different materials listed above.
    - e. Perimeter joints between materials listed above and frames of doors and louvers.
    - f. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
  - 3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Vertical joints on exposed surfaces of unit masonry and partitions.
    - c. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Urethane, S, NS, 25, NT.
  - 3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
  - 1. Joint Locations:
    - a. Control joints on exposed interior surfaces of exterior walls.
    - b. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
  3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors.
- E. Joint-Sealant Application: Concealed mastics.
1. Joint Locations:
    - a. Aluminum thresholds.
    - b. Other joints as indicated on Drawings.
  2. Joint Sealant: Butyl-rubber based.
  3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors.

END OF SECTION 07920

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## SECTION 08113 - 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 08710 "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 ANSI/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.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

#### 1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.6 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 electrical raceway and preparation for electrified hardware, access control systems, and security systems.
  - 7. Details of anchorages, joints, field splices, and connections.
  - 8. Details of accessories.
  - 9. Details of moldings, removable stops, and glazing.
- C. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.
- D. Samples for Verification:
  - 1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
  - 2. Fabrication: Prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
    - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
    - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.
- E. 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.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For door inspector.
  - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
  - 2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
  - 3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.
- B. Product Test Reports: For each type of for tests performed by a qualified testing agency indicating compliance with performance requirements.
- C. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

- D. Field quality control reports.

## 1.8 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

## 1.9 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

- 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

- B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

- 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

## 1.10 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 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Ceco Door; AADG, Inc.; ASSA ABLOY.

2. Curries, AADG, Inc.; ASSA ABLOY Group.
3. Steelcraft; Allegion plc.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 1.10 when tested according to ASTM C518.

## 2.3 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. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.

### 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 0.042 inch., with minimum A40 coating.
- d. Edge Construction: Model 2, Seamless.
- e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
- 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 where required for attachment of weather stripping 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, Vertical steel stiffener.

### 2. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch., with minimum A40 coating.
- b. Construction: Full profile welded.

### 3. Exposed Finish: Factory.

## 2.4 HOLLOW-METAL PANELS

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.



## 2.5 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. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

## 2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- 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.
- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 08800 "Glazing."

## 2.7 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
  - 1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
  - 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.
- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with hairline joints.
  - 1. Provide stops and moldings flush with face of door, and with squarestops unless otherwise indicated.
  - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  - 3. 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.
  - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
  - 5. 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.

## 2.8 STEEL FINISHES

- A. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with ANSI/SDI A250.3.
  - 1. Color and Gloss: As selected by Engineer from manufacturer's full range.

## 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. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.2 INSTALLATION

- A. 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 ANSI/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. Solidly pack mineral-fiber insulation inside frames.
  - 4. 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 ANSI/SDI A250.8.

### 3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Engineer.
- B. Inspections:
  - 1. Fire-Rated Door Inspections: Inspect each fire-rated door according to NFPA 80, Section 5.2.
  - 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

### 3.4 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08113

## SECTION 08710 - 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 08113 "Hollow Metal Doors and Frames" for astragals provided as part of labeled fire-rated assemblies and for door silencers provided as part of hollow-metal 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 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Conference participants shall include Installer's Architectural Hardware Consultant and security consultant.

- B. Keying Conference: Conduct conference at Project site.

- 1. Conference participants shall include Installer's Architectural Hardware Consultant and security consultant.

2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:
  - a. Flow of traffic and degree of security required.
  - b. Preliminary key system schematic diagram.
  - c. Requirements for key control system.
  - d. Requirements for access control.
  - e. Address for delivery of keys.

## 1.5 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. Shop Drawings: For electrified door hardware.
  1. Include diagrams for power, signal, and control wiring.
  2. Include details of interface of electrified door hardware and building safety and security systems.
- C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.
  1. Tag Samples with full product description to coordinate Samples with door hardware schedule.
- D. Samples for Initial Selection: For each type of exposed finish.
- E. Samples for Verification: For each type of exposed product, in each finish specified.
  1. Sample Size: Full-size units or minimum 2-by-4-inch Samples for sheet and 4-inch long Samples for other products.
    - a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
  2. Tag Samples with full product description to coordinate Samples with door hardware schedule.
- F. 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, fire rating, 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.

- G. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Architectural Hardware Consultant.
- B. Product Certificates: For each type of electrified door hardware.
  1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.
- C. 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.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.
- B. Schedules: Final door hardware and keying schedule.

#### 1.8 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, Engineer, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
  2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
  3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- 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).

#### 1.9 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.

#### 1.10 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. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
    - b. Exit Devices: Two years from date of Substantial Completion.
    - c. 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.
  - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
  - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
- C. 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.
- D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design" ICC A117.1 and Texas Accessibility Standards.
  - 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. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
  - 3. Bevel 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.
  - 5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

### 2.3 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Allegion plc.
  - b. Hager Companies.
  - c. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

## 2.4 SELF-CLOSING HINGES AND PIVOTS

### A. Self-Closing Hinges and Pivots: BHMA A156.17.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Allegion plc.
  - b. Hager Companies.
  - c. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

## 2.5 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Allegion plc.
  - b. Hager Companies.
  - c. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

## 2.6 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
  1. Bored Locks: Minimum 1/2-inch latchbolt throw.
  2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
  3. Deadbolts: Minimum 1.25-inch bolt throw.
- C. Lock Backset: 2-3/4 inches unless otherwise indicated.

- D. Lock Trim:
  - 1. Description: Manufacturer's design designation.
  - 2. Levers: Forged.
  - 3. Escutcheons (Roses): Forged.
  - 4. Dummy Trim: Match lever lock trim and escutcheons.
- E. 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.
  - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  - 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
  - 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- F. Mortise Locks: BHMA A156.13; Security Grade 1; stamped steel case with steel or brass parts; Series 1000.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allegion plc.
    - b. Hager Companies.

## 2.7 AUXILIARY LOCKS

- A. Mortise Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allegion plc.
    - b. Hager Companies.

## 2.8 ELECTRIC STRIKES

- A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.

## 2.9 EXIT LOCKS AND EXIT ALARMS

- A. Exit Locks and Alarms: BHMA A156.29, Grade 1.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Precision Hardware, Inc.; dormakaba Group.
- b. SARGENT Manufacturing Company; ASSA ABLOY.

## 2.10 SURFACE BOLTS

- A. Surface Bolts: BHMA A156.16.

## 2.11 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

## 2.12 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic Flush Bolts: BHMA A156.3, Type 25; minimum 3/4-inch throw; with dust-proof strikes; designed for mortising into door edge. Include wear plates.
- B. Self-Latching Flush Bolts: BHMA A156.3, Type 27; minimum 3/4-inch throw; with dust-proof strikes; designed for mortising into door edge. Include wear plates.

## 2.13 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allegion plc.
    - b. Hager Companies.
    - c. Precision Hardware, Inc.; dormakaba Group.

## 2.14 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.
  1. Core Type: Interchangeable.
- C. High-Security Lock Cylinders: BHMA A156.30; Grade 1 permanent cores that are removable; face finished to match lockset.
  1. Type: M, mechanical.
- D. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

- E. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

## 2.15 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. No Master Key System: Only change keys operate cylinders.
    - a. Provide three-cylinder change keys.
  - 2. Master Key System: Change keys and a master key operate cylinders.
    - a. Provide three-cylinder change keys and five master keys.
  - 3. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
    - a. Provide three-cylinder change keys and five each of master and grand master keys.
  - 4. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.
    - a. Provide three-cylinder change keys and five each of master, grand master, and great-grand master keys.
  - 5. Existing System:
    - a. Master key or grand master key locks to Owner's existing system.
  - 6. 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: Information to be furnished by Owner.

## 2.16 KEY CONTROL SYSTEM

- A. Key Control Cabinet: BHMA A156.28; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Lund Equipment Co., Inc.
  - b. MMF Industries.
  - c. TelKee; Oasis International.
2. Wall-Mounted Cabinet: Grade 1 cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
- B. Key Lock Boxes: Designed for storage of two keys.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. HPC, a Hudson Lock Company.
    - b. Kidde; Carrier Global Corporation.
    - c. Knox Company.
- C. Key Control System Software: Multiple-index system for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.

## 2.17 OPERATING TRIM

- A. Operating Trim: BHMA A156.6; stainless steel unless otherwise indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allegion plc.
    - b. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
    - c. Trimco.

## 2.18 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.
- B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: BHMA A156.22.

## 2.19 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.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Allegion plc.
  - b. Hager Companies.

## 2.20 MECHANICAL STOPS AND HOLDERS

### A. Wall- and Floor-Mounted Stops: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hiawatha, Inc; a division of the Activar Construction Products Group.
  - b. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
  - c. Trimco.

## 2.21 OVERHEAD STOPS AND HOLDERS

### A. Overhead Stops and Holders: BHMA A156.8.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hager Companies.
  - b. Rixson Specialty Door Controls; ASSA ABLOY.
  - c. SARGENT Manufacturing Company; ASSA ABLOY.

## 2.22 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 E283 with tested pressure differential of 0.3-inch wg, as follows:
  1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.
  2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
  3. Gasketing on Double Doors: 0.50 cfm per ft. of door opening.

## 2.23 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. National Guard Products, Inc.
  - b. Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
  - c. Rixson Specialty Door Controls; ASSA ABLOY.

## 2.24 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.

## 2.25 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hager Companies.
  - b. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
  - c. Trimco.

## 2.26 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Engineer.
  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, wood, 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. Fire-Rated Applications:
  - a. Machine Screws: For the following:
    - 1) Hinges mortised to doors or frames.
    - 2) Strike plates to frames.
    - 3) Closers to doors and frames.
  - b. Steel Through Bolts: For the following unless door blocking is provided:
    - 1) Surface hinges to doors.
    - 2) Closers to doors and frames.
    - 3) Surface-mounted exit devices.
3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

## 2.27 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, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. 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. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
- B. 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.
- C. 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, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
  - 1. Replace construction cores with permanent cores as directed by Owner.
  - 2. Furnish permanent cores to Owner for installation.
- F. 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.
  - 2. Key Lock Boxes: Install where indicated or approved by Engineer to provide controlled access for fire and medical emergency personnel.
  - 3. Key Control System Software: Set up multiple-index system based on final keying schedule.
- G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible overhead. Verify location with Engineer.
  - 1. Configuration: Provide one power supply for each door opening with electrified door hardware.
- H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07920 "Joint Sealants."

- I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- J. 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.
- K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

### 3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
  - 1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
  - 2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
  - 3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

### 3.6 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.

### 3.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

### 3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

### 3.9 DOOR HARDWARE SCHEDULE

- A. Hardware Component Key:
  - 1. MK - McKinney.
  - 2. PE – Pemko
  - 3. BE – BEST Locks & Closers
  - 4. SA – SARGENT
  - 5. VD – Von Duprin
  - 6. RO – Rockwood
  - 7. NO – Norton
  - 8. OT – Other

B. Hardware Sets:

**Set: 1.0**

Doors: DA-100A, DA-102A

Description: EXTERIOR HM PAIR NIGHTLATCH FUNCTION SVR

2 Continuous Hinge	CFM x Height Req x HD1		PE	087100
1 Nightlatch	9927.NL .LBR x Lever x Keyed to Facility Standard	.626	VD	087100
1 Exit Only	9927.EO .LBR	.626	VD	087100
2 Surface Closer w/ Hvy Dty Stop	UNI7500	689	NO	087100
2 Kick Plate (Pairs)	K1050 10" x 1" LDW CSK BEV	US32D	RO	087100
1 Threshold (Thermal Broken)	252x3AFG		PE	087100
1 Gasketing	2891AV Head x Jambs		PE	087100
1 Rain Guard	346C + 4" ODW		PE	087100
2 Sweep	315CN		PE	087100
1 Astragal	18041CNB		PE	087100

END OF SECTION 08710

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## SECTION 08919 - FIXED LOUVERS

### 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. Fixed extruded-aluminum] and formed-metal louvers.

#### 1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- D. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
  - 1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
  - 2. Show mullion profiles and locations.
- C. Samples: For each type of metal finish required.

## 1.5 DELEGATED-DESIGN SUBMITTALS

- A. For louvers indicated to comply with structural performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Windborne-debris-impact-resistance test reports.
- C. Sample Warranties: For manufacturer's special warranties.

## 1.7 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## 1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## 1.9 WARRANTY

- A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
  - 1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Warranty Period: 10 years from date of Substantial Completion.



## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

### 2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Drainable-Blade Louver:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Greenheck Fan Corporation.
    - b. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
  - 2. Louver Depth: 4 inches.
  - 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
  - 4. Finish: Mill
  - 5. Louver Performance Ratings: Refer louver schedule in HVAC sheet.
  - 6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

### 2.4 FIXED FORMED-METAL LOUVERS

- A. Vertical Blade Sand Louver:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Greenheck Fan Corporation.
  - b. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
2. Louver Depth: 4 inches.
3. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch.
4. Mullion Type: Exposed.
5. Sand trap efficiency: 90%
6. Louver Performance Ratings: Refer Louver schedule in HVAC sheets.
7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

## 2.5 LOUVER SCREENS

- A. General: Provide screen at louvers indicated.
  1. Screen Location for Fixed Louvers: Interior face.
  2. Screening Type: Bird screening.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
  1. Metal: Same type and form of metal as indicated for louver to which screens are attached.
  2. Finish: Same finish as louver frames to which louver screens are attached.
  3. Type: Non-rewirable, U-shaped frames.
- D. Louver Screening for Aluminum Louvers:
  1. Bird Screening: Aluminum, 1/2-inch-square mesh, 0.063-inch wire.
  2. Bird Screening: Galvanized steel, 1/2-inch-square mesh, 0.041-inch wire.

## 2.6 MATERIALS

- A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
  1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
  2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
  3. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless-steel fasteners.

4. For fastening stainless steel, use 300 series stainless-steel fasteners.
  5. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Post installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.7 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
  2. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated.
- C. Maintain equal louver blade spacing to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
1. Frame Type: Channel unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.8 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. 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 Engineer from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and openings, 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 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

### 3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. 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.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07920 "Joint Sealants" for sealants applied during louver installation.

### 3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

- C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Engineer, remove damaged units, and replace with new units.
  - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08919

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## SECTION 09912 - 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:

1. Primers.
2. Water-based finish coatings.
3. Solvent-based finish coatings.
4. Dry fall coatings.

- B. Surfaces not included as part of field-applied finish work, unless otherwise indicated:

1. Pre-finished Items: Do not include painting when factory-finishing or installer-finishing is specified for such items, such as but not limited to architectural woodwork and casework, metal roof edging systems, pre-finished partition systems, acoustic materials, toilet enclosures, elevator entrance doors, frames, and equipment, and mechanical and electrical equipment, including, fixtures, switchgear, distribution cabinets, and light fixtures.
2. Concealed Surfaces: Finishing of walls and ceilings in concealed and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.
3. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials.
4. Operating Parts: Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motors, and fan shafts.
5. Code-required Labels: Do not paint over Underwriters' Laboratories, Warnock-Hershey or Factory Mutual labels, or any equipment identification, performance rating, name, or nomenclature plates.

#### 1.3 DEFINITIONS

- A. MPI Gloss Levels: Following define gloss levels according to ASTM D 523:

1. MPI Gloss Level 1 - Traditional Matte or Flat Finish: Maximum five units at 60 degrees and 10 units at 85 degrees.
2. MPI Gloss Level 2 - Velvet-Like Finish: Maximum 10 units at 60 degrees and 10 to 35 units at 85 degrees.
3. MPI Gloss Level 3 - Traditional Eggshell-Like Finish: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.

4. MPI Gloss Level 4 - Satin-Like Finish: 20 to 35 units at 60 degrees and minimum 35 units at 85 degrees.
  5. MPI Gloss Level 5 - Traditional Semi-Gloss Finish: 35 to 70 units at 60 degrees.
  6. MPI Gloss Level 6 - Traditional Gloss: 70 to 85 units at 60 degrees.
  7. MPI Gloss Level 7 - High Gloss: Minimum 85 units at 60 degrees.
- B. Paint: Various coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials, whether used as prime, intermediate or finish coats.
- C. Finished Areas: Interior rooms, areas, and spaces in which exposed surfaces are finished by Work of this Section or other Sections. Non-exposed spaces above suspended ceilings are not to be included as part of painting Work, unless otherwise indicated.
- D. Utility Areas: Exterior and interior rooms, areas, and spaces dedicated for plumbing, mechanical, electrical, communication, and safety equipment.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
1. Indicate.
  2. VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
1. Submit Samples on rigid backing, 8 inches square.
  2. Apply coats on Samples in steps to show each coat required for system.
  3. Label each coat of each Sample.
  4. Label each Sample for location and application area.
- D. 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 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Upon conclusion of painting, Contractor, paint manufacturer, or supplier shall submit a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal that includes:
1. Area Summary with finish schedule.
  2. Area Detail designating where each product, color, and finish was used.
  3. Product data pages and safety data sheets.
  4. Care and cleaning instructions.
  5. Touch-up procedures.
  6. Color samples, 4 inches by 5 inches, of each color and finish.



## 1.6 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.

## 1.7 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Engineer will select one surface to represent surfaces and conditions for application of each paint system.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
    - b. Other Items: Engineer will designate items or areas required.
  - 2. Final approval of color selections will be based on mockups.
    - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Engineer at no added cost to Owner.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer 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.

## 1.8 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 degrees F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

## 1.9 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

- C. Lead Paint: It is not expected that lead paint will be encountered in the Work.
  - 1. If suspected lead paint is encountered, do not disturb; immediately notify Engineer and Owner.

## 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. Benjamin Moore & Company (BMC).
  - 2. PPG Paints (PPG).
  - 3. The Sherwin-Williams Company (SWC).
- B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
  - 1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

### 2.2 PAINT PRODUCTS, 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. 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.
- B. Colors: As selected by Engineer from manufacturer's full range.
  - 1. Ten percent of surface area will be painted with deep tones.

### 2.3 MIXING

- A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogenous coating with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
- B. Mix and prepare painting materials in accordance with manufacturer's directions.
- C. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

- D. Stir materials before application to produce a mixture of uniform density and stir during application. Do not stir surface film into material. Remove film and strain material before using.
- E. Do not thin painting materials unless recommended by manufacturer. When paint thinning is required, comply with manufacturer's printed instructions; use only thinners approved by paint manufacturer.

## 2.4 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
  - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
  - 2. Testing agency will perform tests for compliance with product requirements.
  - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

## 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.
  - 1. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
  - 2. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
  - 3. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Masonry (Clay and CMUs): 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

2. Repainting of Previously Painted Surfaces: Verify conditions and compatibility between new and existing painting products.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with paint manufacturer's written preparation instructions and recommendations 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, rust, scale, 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.
  2. Remove mildew, efflorescence, deleterious films, and foreign material from surface by appropriate methods as recommended by manufacturer.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. 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.
- 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.
1. SSPC-SP 16, "Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- G. Aluminum Substrates: Remove loose surface oxidation.
- H. All Substrates: Remove foreign materials, dust, dirt, and other deleterious films that impairs bond of paints to substrates.
- I. Previously Finished Surfaces: Comply with paint manufacturer's specifications appropriate for substrate to be coated, for proper preparation of previously finished surfaces.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
  - 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. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
  - 6. Comply with manufacturer's recommendations for drying time required between succeeding coats.
- 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. Film Thickness: Apply paint in wet film thickness (WFT) recommended by paint manufacturer to achieve specified dry film thickness (DFT) for each coat of paint. Since DFT varies among manufacturers, this reference is not included in Article "Interior Painting Schedule."

### 3.4 FIELD QUALITY CONTROL FOR CONCRETE AND CONCRETE MASONRY UNIT SUBSTRATES

- A. General: Field quality control referenced in this Article includes testing of both pre-application quality assurance and post-installation quality control of high-performance coatings. Employ approved testing and inspecting agency to perform quality assurance and control.
  - 1. Perform Quality Control Testing in the order identified in the following subparagraph.
    - a. Testing Order: pH, Surface Profile, Moisture, followed by Dry Film Thickness Testing, Adhesion Testing, and Holiday Testing.
    - b. Repair substrate, touch up, and restore coated surfaces damaged by testing.
    - c. If test results show that dry film thickness, holiday, or pull-off strength of applied coating does not comply with coating manufacturer's written instructions, pay for testing and apply additional coats as needed to provide dry film thickness, pull-off strength that complies with coating manufacturer's written instructions.

- B. Quality Assurance Testing:
  - 1. Surface Preparation Testing:
    - a. Inspect and test condition of substrate for compliance with coating manufacturer's requirements.
- C. Quality Control Testing:
  - 1. Dry Film Thickness Testing:
    - a. Inspect and test coatings for dry film thickness per ASTM D6132.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
  - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
  - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
  - 3. Allow empty paint cans to dry before disposal.
  - 4. Collect waste paint by type and deliver to recycling or collection facility.
- 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 Engineer, 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

- A. Paragraphs below identify specific painting materials and appropriate specified painting system to be used on a particular substrate; actual substrate material surfaces for this Project shall be as indicated in this Interior Painting Schedule and as indicated on Drawings.
- B. CMU Substrates.
  - 1. High Performance, Two Component Water-Based Coating System - Walls:
    - a. Primer: Alkali resistant, latex, flat:
      - 1) SWC: Loxon Concrete & Masonry Primer, LX02-50 Series.
      - 2) PPG: Perma-Crete Int/Ext Alkali Resistant Primer, 4-603XI.

- 3) BMC: Fresh Start All Purpose Primer 023.
- b. Intermediate Coat: Latex, matching topcoat.
- c. Topcoat: Two component, water-based epoxy, eggshell finish (MPI Gloss Level 3):
  - 1) SWC: Pro Industrial Waterbased Catalyzed Epoxy Eg-Shel, B73-360 Series.
  - 2) PPG: Aquapon WB EP Two-Component Ultra Low VOC Water-Based Epoxy Semi-Gloss Coating 98E-1 / 98E-100 Series.
  - 3) BMC: Corotech Pre-Catalyzed Waterborne Epoxy Eggshell V342.

END OF SECTION 09912

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## SECTION 13610 - PROCESS CONTROL AND ENTERPRISE MANAGEMENT SYSTEMS GENERAL PROVISIONS

### 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 procurement of the services of a Process Control System Supplier (PCSS) to provide all materials, equipment, labor, and services required to achieve a fully integrated and operational system as specified herein, in "Related Requirements" under this Article, and in related drawings, except for those services and materials specifically noted.
- B. Under this contract, the PCSS will also serve as the Applications Engineer System Supplier (AESS)
- C. The work must include furnishing, installation, testing, and commissioning of instrumentation and control system at South Laredo Wastewater Treatment Plant Blower Building Enclosure and integrating with existing instrumentation and control system as described in the contract documents.
- D. Existing differential pressure switch on cooling air intake filter to be relocated on controls cabinet filter. Signals from instruments must be wired to each blower local control panel as shown on the drawings.
- E. Existing differential pressure switch on process air intake filter to be relocated on filter in process air intake plenum box. Signals from instruments must be wired to each blower local control panel as shown on the drawings.
- F. Supply fan differential pressure switch provided by the contractor for Blower Room 1 and 2 must be wired to PLC-BBG. Room temperature switches provided by the contractor for Blower Room 1 and 2 must be wired to PLC-BBG. PLC-BBG panel drawings indicate spare DI slots are available for wiring the four discrete signals. PCSS to independently verify the available slots and wire the signals.
- G. Program the existing PLC-BBG to accept signals from the two Supply Fan differential pressure switches and the two Blower room temperature switches. Confirm and configure ethernet connection from the blower master control panel to the PLC-BBG.
- H. Program the plant HMI to display the Supply Fan differential pressure alarms and the blower room high temperature alarms. The differential pressure alarm for each blower Control Cabinet Cooling Filter and Process Air Intake Plenum Box Filter should also be displayed on the Plant HMI.

- I. Include auxiliary and accessory devices necessary for system operation or performance, such as transducers, relays, signal amplifiers, intrinsic safety barriers, signal isolators, software, and drivers to interface with existing equipment or equipment provided by others under other Sections of these specifications, whether indicated on the Drawings or not.
- J. All equipment and installations to satisfy applicable Federal, State and local codes. Refer to Electrical drawings for area classifications for Class and /Division ratings.
- K. Use the equipment, instrument, and loop numbering scheme indicated on the Drawings and in the specifications in the development of the submittals. Do not deviate from or modify the numbering scheme.
- L. Equipment must be fabricated, assembled, installed, and placed in proper operating condition in full conformity with the project Specifications, Drawings, engineering data, instructions, and recommendations of the equipment manufacturer as approved by the Engineer.
- M. In order to ensure compatibility among all equipment, it must be the responsibility of the PCSS to coordinate and field verify all interface requirements with mechanical and electrical subcontractors and furnish any signal isolation devices that might be required.
- N. Coordinate, and schedule all required testing and training with the Owner, Engineer, General Contractor, and all affected subcontractors.
- O. Coordinate the Control System for proper operation with related equipment and materials furnished by other suppliers under other sections of these Specifications. Should any coordination issues arise with the PCSS, resolve and insure proper coordination between the PCSS and other manufacturer-supplied equipment.
- P. Provide supervision of all field-wiring terminations associated with the instrumentation. The electrical subcontractor must provide all conduit and wiring between field devices, PLC cabinets, etc.
- Q. Provide and install communications network as shown in Drawings, including but not limited to all necessary ancillary equipment, all associated protocol converters, and twisted pair media equipment. Provide all necessary ancillary equipment whether or not it is shown on the Drawings.
- R. Provide coordination with the General Contractor and electrical subcontractor to review the conduit and/or raceway layout and construction sequencing prior to installation and review these layouts with the cable manufacturers to ensure conduit and/or raceway compatibility with the systems and materials being furnished.
- S. Related Requirements:
  - 1. Section 13610 “Process Control System Testing”.
  - 2. Section 13612 “Process Control System Training”.
  - 3. Section 13613 “Process Control Descriptions.”

### 1.3 DEFINITIONS

- A. Process Control System Supplier (PCSS): The entity responsible for providing all materials, equipment, labor, and services required to achieve a fully integrated and operational control system.
- B. Applications Engineering System Supplier (AESS): The entity who provides all programming, configuration, and related services for the control system equipment provided by the PCSS.
- C. Maintenance of Plant Operations (MOPO): A construction plan which prevents or limits process disruptions during construction.
- D. Leadership in Energy and Environmental Design (LEED): A green building certification indicating that a building was designed and constructed to be environmentally responsible and use resources efficiently.

### 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.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, mountings, 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. Detail fabrication and assembly of control equipment, control panels, and instrumentation as specified herein.
  - 4. Include diagrams for power, signal, and control wiring.
- C. Qualifications Submittal:
  - 1. For non-listed PCSS', submit, within 30 calendar days after Notice to Proceed, detailed information on staff and organization to indicate compliance with the Quality Assurance requirements of this Section. The Qualifications submittal is required to be submitted and approved before any further submittals will be accepted. Failure to meet the minimum requirements is grounds for rejection as a PCSS. The Qualifications Submittal to contain the following:
    - a. Copies of ISA CCST Level 1 certificates for all field technicians or resumes demonstrating field experience.
    - b. Notarized statement from the firm's financial institution demonstrating ability for the firm to meet the obligations necessary for the performance of the work.
    - c. Copy of UL-508 certificate for panel fabrication facilities.

- d. Project references for water or wastewater projects as defined in the “Quality Assurance” paragraphs.
- e. Documentation to demonstrate the ability to complete this project including resumes of key staff, financial capacities, details on engineering, design, fabrication, and field service capacity, and location of staff responsible for responding to the site within four hours to resolve startup issues.

D. Project Plan, Deviation List, and Schedule Submittal:

1. Submit, within 45 calendar days after Notice to Proceed, a Project plan. Submit for approval the Project Plan before further submittals are accepted. The Project Plan to contain the following:
  - a. Overview of the proposed control system describing the understanding of the project work, interfaces to other systems, schedule, startup, and coordination. Include a general discussion of startup, approach to testing and training, and other tasks as required by these specifications.
  - b. Project personnel and organization including the PCSS project manager, project engineer, and lead project technicians. Include resumes of each of these individuals and specify in writing their commitment to this project. These do not need to be submitted again if already submitted in the Qualification submittal.
  - c. Sample formats of the shop drawings to be submitted and in conformance with the requirements of the Specifications. At a minimum include samples of I/O wiring diagrams.
2. Define Exceptions to the Specifications or Drawings in a Deviation List consisting of a paragraph-by-paragraph review of the Specifications indicating acceptance or any proposed deviations, the reason for exception, the exact nature of the exception and the proposed substitution so that an evaluation may be made by the Engineer. Specifically state if no exceptions are taken to the specifications or drawings. If there is no statement by the PCSS, then it is acknowledged that no exceptions are taken.
3. The PCSS must coordinate their work with the General Contractor’s overall schedule. PCSS schedule incorporates all PCSS milestones including but not limited to the following:
4. CSS must coordinate their work with the General Contractor’s overall schedule. PCSS schedule incorporates all PCSS milestones including but not limited to the following:
  - a. Schedule for all subsequent project submittals. Include the time required for Contractor’s submittal preparation, Engineer’s review time, and a minimum of two complete review cycles.
  - b. Proposed dates for all project coordination meetings.
  - c. Shipment of instrument and control system equipment.
  - d. Installation of instrument and control system equipment.
  - e. Testing: Schedule for all testing.
  - f. Schedule for system cutover, startup, and/or going on-line for each major system. At a minimum include the schedule for each process controller and HMI server/workstation provided under this Contract.
  - g. Schedule for all training including submittal and approval of O&M manuals, factory training, and site training.

- h. Arrange project schedule to accommodate requirements of AESS to develop, test, troubleshoot, and train Owner on PLC and HMI systems. Timing of these coordination efforts to be determined by PCSS.
  - 1) Completion of AESS's Application Software Operational Readiness Tests: Twenty-one calendar days after successful completion and acceptance by the Engineer of PCSS's operational readiness testing.
  - 2) Completion of AESS's Functional Acceptance Tests: Twenty-one calendar days after successful completion and acceptance by the Engineer of PCSS's functional acceptance testing.
  - 3) Completion of Training on PLC and HMI equipment: Twenty-one calendar days after successful completion and acceptance by the Engineer of PCSS's training.
  
- 5. Component and Wiring Identification and Tagging Plan:
  - a. All components provided by PCSS require a tag, label, or nameplate. Review specifications and provide a drawing indicating the tagging and labeling scheme used by the PCSS.
  - b. Provide detailed information so Engineer can review the following characteristics for each type of tag, label, or nameplate for the different types of components provided above.
    - 1) Size or range of size of the tag, label or nameplate.
    - 2) Font style.
    - 3) Material.
    - 4) Color(s).
  
- E. Panel Layout Drawings and Wiring Diagrams Submittal:
  - 1. Wiring Diagrams Submittal:
    - a. PCSS to provide complete wiring diagrams showing all wiring connections in the I/O system where direct hardwired interfaces exist between the PCSS control panels and vendor provided control panels furnished under other Divisions. This includes but is not limited to terminal block numbering, relay contact information, instruments, equipment, and control panel names. Include drawings in Final O&M submittal. Leaving this information blank on Final Documentation drawings is not acceptable.
    - b. Panel wiring diagrams depicting wiring within and on the panel as well as connections to external devices. If ISA Loop Wiring Diagrams are specified below, equipment external to the control panel and related external connections do not need to be shown on the Panel Wiring Diagrams. Panel wiring diagrams include power and signal connections, UPS and normal power sources, all panel ancillary equipment, protective devices, wiring and wire numbers, and terminal blocks and numbering. Field device wiring includes the device ISA-tag and a unique numeric identifier. Diagrams identify all device terminal points that the system connects to, including terminal points where I/O wiring lands on equipment not supplied by the PCSS. Wiring labeling used on the drawings match that shown on the Contract Documents or as developed by the PCSS and approved by the Engineer. I/O wiring numbered with rack number, slot number, and point number.

Two-wire and four-wire equipment to be clearly identified, and power sources noted. Submit final wire numbering scheme. Provide panel drawings that are 11-inch x 17-inch in size.

F. Testing Plan Submittals:

1. Refer to Section 13612 “Process Control System Testing” for specific testing submittal requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For any named PCSS, submit a statement on company letterhead indicating that the requirements in the “Quality Assurance” paragraph below are met by the firm.
- B. Product Test Reports: Refer to individual instrument, component or hardware specifications for specific requirements.
- C. Evaluation Reports: Refer to individual instrument, component or hardware specifications for specific requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For all PCSS supplied hardware to include in operation and maintenance manuals.
  1. Submit in accordance with Section 01782 “Operation and Maintenance Data.”
  2. Include the following information on the operations and maintenance manuals:
    - a. Table of Contents:
      - 1) Provide a Table of Contents for the entire manual with the specific contents of each volume clearly listed. Include the complete Table of Contents in each volume.
    - b. Instrument and Equipment Lists:
      - 1) Develop the following lists in Microsoft Excel format:
        - a) An instrument list or spreadsheet for all instruments supplied including tag number, description, specification section and paragraph number, manufacturer, model number, calibrated range, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.
        - b) An equipment list or spreadsheet for all non-instrument devices supplied listing description, specification section and paragraph number, manufacturer, model number, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.

c. Equipment Operations and Maintenance Information:

- 1) Provide ISA-TR20.00.01-2001 data sheets for all field instruments. For non-field instrumentation devices, provide a cover page for each device, piece of equipment, and OEM software that lists date, specification number, product name, manufacturer, model number, Location(s), and power required. Preferred format for the cover page is ISA-TR20.00.01-2001, general data sheet; however, other formats will be acceptable provided they contain all required information.
- 2) Provide either new documentation written specifically for this project or modified standard vendor documentation to the vendor O&M documentation for each device, piece of equipment, or OEM software. Indicate with arrows or circles all portions that apply to all standard vendor documentation furnished. Neatly line out or cross out all portions that do not apply. Remove groups of pages or sections that do not apply to the specific model supplied.
- 3) Provide the record documentation of the completed test forms with sign-offs as specified in Section 13612 "Process Control System Testing."
- 4) Include instrument/equipment calibration and configuration forms.

d. As-Built Drawings:

- 1) Complete as-built drawings, including all drawings and diagrams specified in this section under the "Submittals" section. Include on the drawings all termination points on all equipment the system is connected to, including terminal points of equipment not supplied by the PCSS. Provide electronic files for all drawings produced. Provide drawings in AutoCAD ".dwg" format and in Adobe Acrobat format.
- 2) Include on as-built documentation information from submittals, as described in this Specification, updated to reflect the as-built system. Incorporate errors in or modifications to the system resulting from the Factory and/or Functional Acceptance Tests.

B. Operations and Maintenance Data - Operators' Manual:

1. Provide Operator's Manuals prior to final acceptance of the system.
2. Separately bind and include in the manual all information necessary for the operator to monitor and control the plant from the control system. Write the manuals in non-technical terms and organize for quick access to each detailed description of the operator's procedure. Include the following information:
  - a. A comprehensive table of contents of the manual.
  - b. A simple overview of the entire system indicating the function and purpose of major control system components described by area or building.

C. Electronic O&M Information:

1. In addition to the hard copy of O&M data, provide an electronic version of all equipment manuals and data sheets, along with any software back-up of configuration files, on USB flash drive. Supply electronic documents in Adobe Acrobat format.

- D. Include information as specified in Section 01782 "Operation and Maintenance Data" on the cover and edge of each volume.

#### 1.7 MAINTENANCE MATERIAL SUBMITTAL

- A. Not Applicable.

#### 1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: PCSS to hold a valid UL-508 certification for their panel fabrication facility.
- B. Responsible for the technical supervision of the installation by providing on-site supervision to the installers of the various components.
- C. The Process Control System Supplier (PCSS) to be a "systems integrator" regularly engaged in the design and the installation of instrumentation systems and their associated subsystems as they are applied to the municipal water and wastewater industry. For the purposes of this Specification Section, a "systems integrator" means an organization that complies with all of the following criteria:
  - 1. Employs personnel on this project who have successfully completed ISA or manufacturer's training courses on general process instrumentation and configuration and implementation of the specific programmable controllers, computers, and software proposed for this project. Key personnel to hold ISA CCST Level 1 certification or have a minimum of 10 years of verifiable plant startup experience. Key personnel includes, as a minimum, the lead field technician.
  - 2. Has successfully completed work of similar or greater complexity on at least three previous projects within the last five years. Successful completion is defined as a finished project completed on time, without any outstanding claims or litigation involving the PCSS. Potential references for projects where the PCSS's contract was of similar size to this project.
  - 3. Has been actively engaged in the type of work specified in this Section for a minimum of five years.
- D. Maintain a permanent, fully staffed, and equipped service facility with full-time employees capable of designing, fabricating, installing, calibrating, and testing the systems specified herein. Respond to on-site problems within 12 hours of notice. Provide an on-site response within four hours of notification starting at two months before scheduled start up to two months after startup completion.
- E. Listed suppliers will not be required to submit a qualifications proposal (see "Informational Submittals"). Contractors interested in listing an equal to the below listed suppliers to submit PCSS' qualifications for review and approval as specified herein.
- F. Select a PCSS from one of the following:
  - 1. Prime Controls  
1725 Lakepointe Drive



Lewisville, TX 75057  
Phone: 972-227-4849  
Contact: Brian Poarch

2. Or Approved Equal.

G. Being listed in this specification does not relieve any potential PCSS from meeting the qualifications specified in this Section.

#### 1.9 PRECONSTRUCTION TESTING

A. Not Applicable.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 01600 "Product Requirements" for delivery, storage, and handling requirements.

#### 1.11 FIELD CONDITIONS

A. Environmental Requirements: Refer to Electrical Drawings for specific environmental and hazardous area classifications.

B. Elevation: Design equipment to operate at the project ground elevation.

C. Temperature:

1. Outdoor area equipment to operate between -4 to 122 degrees F (-20 to 50 degrees C) ambient.
2. Equipment in indoor locations operate between 50 to 95 degrees F (10 to 35 degrees C) degrees ambient minimum.
3. Storage temperatures range from 32 to 122 degrees F (0 to 50 degrees C) degrees ambient minimum.
4. Furnish additional cooling or heating if required by the equipment specified herein.
5. Relative Humidity. Air-conditioned area equipment operate between 20 to 95 percent relative, non-condensing humidity. All other equipment operates between 5 to 100 percent relative, condensing humidity.

D. Do not ship control system equipment located in the control room until the control room areas comply with specified ambient temperature and humidity and free of dust and debris.

#### 1.12 WARRANTY

1. Warranty Period: 1 year(s) from date of Substantial Completion unless noted otherwise in individual specification sections.

## PART 2 - PRODUCTS

### 2.1 GENERAL

#### A. Electrical Requirements for Control System:

1. Operate equipment on a 60 Hertz alternating current power source at a nominal 120 volts, plus or minus 10 percent, except where specifically noted. Regulators and power supplies required for compliance with the above to be provided between power supply and interconnected instrument loop. Supply constant voltage transformers where equipment requires voltage regulation.
2. With the exception for field device network connected devices, all electronic instrumentation utilize linear transmission signals of isolated 4 to 20 mA DC (milliampere direct current) capable of driving a load up to 750 ohms, unless specified otherwise. However, signals between instruments within the same panel or cabinet may be 1-5 VDC (volts direct current).
3. Outputs of equipment that are not of the standard signals as outlined, have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero-based signals will be allowed.
4. All switches have double-pole, double-throw (DPDT) contacts rated at a minimum of 600 VA, unless noted otherwise.
5. Switches and/or signals indicating an alarm, failure or upset condition wired in a fail-safe manner as shown on the P&IDs. A fail-safe condition is when an open circuit generates an alarm state (i.e. contact opens).
6. Materials and equipment UL approved whenever such approved equipment and materials are available.
7. All equipment furnished designed and constructed so that in the event of power interruption, the systems specified all go through an orderly shutdown with no loss of memory and resume normal operation without manual resetting when power is restored, unless otherwise noted.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting performance of the Work.
- B. Examine instruments before installation. Reject products that are wet, moisture damaged, or mold damaged.
- C. Examine walls, floors, roofs, and process area for suitable conditions where instrumentation will be installed.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 GENERAL INSTALLATION

- A. The shield on each process instrumentation cable to be continuous from source to destination and be grounded at only one ground point for each shield.
- B. Provide sunshades for equipment mounted outdoors in direct sunlight. Include sunshades standoffs to allow air circulation around the cabinet. Orient equipment outdoors to face to the North to minimize the impact of glare and ultraviolet exposure on digital readouts.

### 3.3 IDENTIFICATION

- A. Provide identification system for all PCSS provided hardware, instrumentation, and communication cabling.

### 3.4 FIELD QUALITY CONTROL

- A. Refer to individual hardware and instrument specification sections.

### 3.5 STARTUP SERVICE

- A. Refer to Section 13612 “Process Control System Testing.”
- B. Refer to Section 13613 “Process Control System Training.”
- C. Engage a factory-authorized service representative to perform startup service as specified in individual hardware and instrument specification sections.
- D. Weekly on-site coordination meetings with Contractor, Vendors, and AESS as required during active construction period.

END OF SECTION 13610

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## SECTION 13612 - PROCESS CONTROL SYSTEM TESTING

### 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 process control system testing, where the Applications Engineering services are performed by the Contractor.
- B. Related Requirements:
  - 1. Section 13610 “Process Control and Enterprise Management Systems General Provisions.”
  - 2. Section 01910 “General Commissioning Requirements.”
- C. Furnish all labor, materials, equipment and incidentals required to complete the testing of all devices and systems furnished and installed as detailed on Drawings, and as specified herein.

#### 1.3 DEFINITIONS

- A. Process Control System Supplier (PCSS): The entity responsible for providing all materials, equipment, labor, and services required to achieve a fully integrated and operational control system.
- B. Applications Engineering System Supplier (AESS): The entity who provides all programming, configuration, and related services for the control system equipment provided by the PCSS.
- C. Human Machine Interface (HMI): A software-based user interface with supervisory level control and of machine level equipment.
- D. Operator Interface Terminal (OIT): A hardware component of the HMI used for device level control and monitoring.
- E. Programmable Logic Controller (PLC): A ruggedized programmable computer used for industrial automation.
- F. Input/Output (I/O): Analog or digital field instrument signals to be received and interpreted by a PLC.
- G. Uninterruptible Power Supply (UPS): A device capable of providing emergency battery power when the main power source fails.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Refer to Section 136100 “Process Control and Enterprise Management Systems General Provisions.”

#### 1.5 ACTION SUBMITTALS

- A. Refer to Section 13610 “Process Control and Enterprise Management Systems General Provisions.”

- B. Testing Submittals - Submit, in one submittal, the following testing related documents:

- 1. Status signoff forms:

- a. Develop and submit project specific I/O Status and Automatic Control Strategy signoff forms to be used during factory and field testing to organize and track each loop's inspection, adjustment, calibration, configuration, and testing status and sign off. Include sign-off forms for each testing phase showing all loops.

- 1) Example forms are shown in the Appendices.
- 2) Separate forms for factory and field testing can be used, or they can be combined, at the discretion of the PCSS.
- 3) Submit testing forms prior to start of testing.

- 1. Testing Procedures:

- a. Submit detailed procedures proposed to be followed for each of the tests specified herein. The test procedures serve as the basis for the execution of the required tests to demonstrate that the system meets and functions as specified. At a minimum, provide the following test procedures:

- 1) I/O Testing.

- b. Structure documents in an orderly and easy to follow manner to facilitate an efficient and comprehensive test.
- c. Indicate in test procedures all pre-testing setup requirements, all required test equipment, and simulation techniques to be used.
- d. Structure test procedures in a cause-and-effect manner where the inputs are indicated, and the outputs are recorded.
- e. Include in test procedures the demonstration and validation under normal operating conditions and under various failure scenarios as specified in Contract Documents.
- f. Do not start testing until all Testing Submittals have been approved.

- C. Test Documentation:

- 1. Upon completion of each required test, document the test by submitting a copy of the signed off Testing Status forms. Testing is not considered complete until the signed-off forms have been submitted and approved. Submittals of other test documentation, including "highlighted" wiring diagrams with field technician notes, are not acceptable substitutes for the formal test documentation.

## 1.6 INFORMATIONAL SUBMITTALS

### A. Evaluation Reports: For Test Documentation of system:

1. Upon completion of each required test, document the test by submitting a copy of the signed-off Testing Status forms. Testing is not considered complete until the signed-off forms are submitted and approved. Submittal of other test documentation, including "highlighted" wiring diagrams with field technician notes, are not acceptable substitutes for the formal test documentation.

## 1.7 CLOSEOUT SUBMITTALS

- ### A. Refer to Section 13610 "Process Control and Enterprise Management System General Provisions."

## 1.8 COST OF TRAVEL

- ### A. Scheduled tests will only be attended once by Engineer /Owner. If test is not successful, all subsequent tests will be performed at Contractor's expense. Reimburse Owner for all costs, including labor and expenses, invoiced by Engineer and incurred by Owner for subsequent retests.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 TESTING - GENERAL

- #### A. Refer to Section 13610 "Process Control and Enterprise Management System General Provisions."
- #### B. Track results of all testing on a project specific status sign-off form or similar document. The PCSS is responsible for maintaining the sheet. Appendix of this Section has an example template for this sheet.
- #### C. Tests the PCSS is required to perform are as follows:
1. Field Testing:
    - a. Operational Readiness Test (ORT).
    - b. Functional Demonstration Test (FDT).
    - c. Site Acceptance Test (SAT).
- #### D. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment, and data, provide all special testing materials and equipment required for a suitable means of simulation.

- E. PCSS to coordinate all required testing with Contractor, affected Subcontractors, Engineer, and Owner.
- F. Engineer reserves the right to test or re-test any functions.
- G. Correction of Deficiencies:
  - 1. Correct deficiencies in workmanship and/or items not meeting specified testing requirements to meet specification requirements at no additional cost to Owner.
  - 2. Repeat testing, as specified herein, after correction of deficiencies is made until specified requirements are met. Perform work at no additional cost to Owner.

### 3.2 FIELD TESTING - OPERATIONAL READINESS TEST (ORT)

- A. Purpose of ORT is to check that process equipment, instrument installation, instrument calibration, instrument configuration, field wiring, control panels, and all other related system components are ready to monitor and control the processes. This test determines if equipment is ready for operation.
- B. This test to take place prior to FDT and startup. Prior to starting this test, install relevant process equipment and mechanically test instruments installed, control panels installed, and field wiring complete.
- C. Required Documents for Test:
  - 1. Master copy of the PCSS developed field testing sign-off forms.
  - 2. Testing procedures.
  - 3. Calibration forms.
- D. These inspections, calibrations, and tests do not require witnessing. However, Engineer may review and spot-check testing process periodically. All deficiencies found to be corrected by PCSS prior to commencement of Functional Demonstration Test.
- E. PCSS to maintain Sign-off forms and Calibration forms at job site and make them available to Engineer/Owner at any time.
- F. Perform the following tests as part of ORT:
  - 1. Instrument calibration, configuration, and set-up.
  - 2. Input/Output (I/O) Testing to HMI and OITs.
  - 3. Testing of control strategies.
- G. Instrument calibration, configuration, and set-up:
  - 1. Calibrate, configure, and set-up all components and instruments to perform specified functions.
  - 2. Calibration form:
    - a. For any component or instrument requiring dip switch settings, calibration, or custom configuration, maintain a calibration form in field documenting this information. These forms provide a summary of the actual settings used in the field



to allow an Instrument technician to replace the device entirely and configure it to function as it did before.

- b. Add this information to Instrument data sheet and to a copy of manufacturer's standard "Configuration Sheet" or create a separate form.
  - 1) If a separate form, list Project Name, Loop Number, ISA Tag Number, I/O Module Address, Manufacturer, Model Number/Serial Number, Output Range and Calibrated Value.
- c. Some examples of required information are:
  - 1) For Discrete Devices: Actual trip points and reset points.
  - 2) For Instruments: Any configuration or calibration settings entered into instrument
  - 3) For Controllers: Mode settings (PID).
  - 4) For I/O Modules: Dip switch settings, module configuration (if not documented in native programming documentation).
- d. Maintain a copy of these forms in field during testing and make them available for inspection at any time.
- e. For any device that allows a software back-up of configuration files to a laptop, make configuration files available to Engineer/Owner for inspection. Submit as part of Final System Documentation as specified in Section 13610 "Process Control and Enterprise Management Systems General Provisions."

#### H. I/O Testing:

1. Purpose of I/O testing is to check that process equipment, instrument installation, calibration, configuration, field wiring, and control panels are set-up correctly to monitor and control the processes. This test is commonly referred to as a "loop test" or an I/O checkout.
2. PCSS in conjunction with Contractor to test signals under process conditions. Preferred test method will always be to execute test wherever possible to end elements. For example, preferred test will prove valve open/close limit switches by operating valve, not by installing a jumper on limit switch contacts. However, if equipment or process is not available to test a signal over its entire calibrated range, PCSS may test using a simulation method and make a note on sign-off form.
3. Perform the following I/O tests:
  - a. Discrete Input: At device or instrument, change signal condition from inactive to active state. Observe results on all indicators within loop such as HMI screens, OIT screens, pilot lights, horns, beacons, etc.
  - b. Analog Input: Test analog signal over entire engineering range at various intervals including 0, 50%, and 100% as well as on increasing and decreasing range. Observe results on all indicators within loop such as HMI screens, OIT screens, recorders, digital indicators, etc.
  - c. Test discrete output signals by switching equipment to manual control at the HMI and OIT nodes and turning output on or using other means to turn output on. Then verify equipment responds accordingly.

- d. Test analog output signals by switching equipment to manual control at HMI and OIT nodes and turning output on or other means to turn output on. Then verify equipment responds accordingly.
- I. Testing of Automatic Control Strategies:
    1. Verify all automatic control strategies using actual process equipment and instruments, or other means, to verify logic performs as expected. Verify faults and logical failure scenarios for control strategies such as instrument failures, equipment failures, loss of communication between HMI Server and PLC, loss of peer-to-peer communication, out of range testing for analog inputs, loss of power, and all other strategies specified in control strategy document.
  - J. Repeat all systems tests specified under factory testing.
  - K. Test UPS to verify UPS switch power correctly while keeping all UPS powered loads online. Also, test sizing of UPS by switching off-line power to UPS and verify if they maintain specified run time.
  - L. For all panels with enclosures modified by this Contract, test internal control panel temperature under full running conditions to ensure proper cooling/ventilation is being provided.
  - M. Upon successful completion of ORT, PCSS to submit a record copy of test results as specified in PART 1 and request scheduling of FDT.

### 3.3 FIELD TESTING - FUNCTIONAL DEMONSTRATION TEST (FDT)

- A. After facility is started-up and running treatment process in automatic control to extent possible, perform a Functional Demonstration Test. Purpose of FDT is to allow Engineer or Owner representatives to witness actual functionality, performance, and stability of system while connected to process equipment.
- B. Required Documents for Test:
  1. Set of panel drawings and wiring diagrams from ORT with corrections noted.
  2. Set of Contract Documents - all drawings and specifications.
  3. All design-change related documentation.
  4. Signed-off master copy of the PCSS developed field testing signoff forms.
  5. Testing procedures.
  6. Copy of completed calibration forms.
  7. One copy of all O & M Manuals for PCSS supplied equipment.
- C. Perform a witnessed FDT on each process area. To extent possible, repeat testing performed during ORT.
- D. Follow specified daily schedule during factory tests and FDT.
- E. After coordinating with Operations, perform a "Black Start" of the plant to confirm plant operation recovers as specified in Contract Documents. Black start means shutting off power to

the plant and turning it back on. Perform separate tests by recovering the plant while on generator (if a generator is specified) and while on utility power.

- F. Document punch list items and resolutions noted during test on Punch list/Resolution form. In event of rejection of any part or function test procedure, PCSS to perform repairs, replacement, and/or retest within 10 days.
- G. Upon successful completion of the FDT, PCSS to submit a record copy of test results as specified in PART 1.

### 3.4 FIELD TESTING - SITE ACCEPTANCE TEST (SAT)

- A. After completion of FDT, and system is started-up and running treatment process in automatic control to extent possible, system shall undergo a System Acceptance Test (SAT) with a duration of 30 days.
- B. While this test is proceeding, Engineer and Owner have full use of system. Only allow plant operating personnel to operate equipment associated with live plant processes. Plant operations remain the responsibility of Owner and decision of plant operators regarding plant operations are final.
- C. During this test, PCSS personnel to be present as required to address any potential issues that would impact system operation. PCSS is expected to provide personnel for this test who have an intimate knowledge of hardware and software of system. When PCSS personnel are not on-site, PCSS to provide cell phone/pager numbers that Owner personnel can use to ensure that support staff is available by phone and/or on-site within four hours of a request by operations staff.
- D. PCSS to analyze and correct any malfunctions during test. In event of rejection of any part or function, PCSS to perform repairs or replacement within 5 days.
- E. Throughout duration of SAT, do not make software or hardware modifications to the system without prior approval from Owner or Engineer.

END OF SECTION 13612

#### APPENDIX-A: EXAMPLE INPUT/OUTPUT (I/O) STATUS SIGN OFF FORM

An example template for I/O Status signoff form to be used for documenting testing results to Owner is attached. PCSS is required, prior to testing, to create a project specific I/O Status signoff form based on attached template or approved equal. PCSS may obtain an electronic copy of template from Engineer or develop it on their own.

#### APPENDIX-B: EXAMPLE AUTOMATIC CONTROL STRATEGIES SIGN OFF FORM

An example template for Automatic Control Strategies signoff form to be used for documenting testing results to Owner is attached. PCSS is required, prior to testing, to create a project specific Automatic Control Strategies signoff form based on attached template or approved equal. PCSS may obtain an electronic copy of template from Engineer or develop it on their own.

[Project Name] Appendix A - Input/Output (I/O) Status Sign-Off Form

All Sections below are required to be filled out by PCSS as part of Field Testing.  
Instrument Alarm Setpoint - Setpoint for any alarms set by PCSS.  
Wiring Complete - Signal wired from field device to PLC.  
I/O Tested - Signal tested from field device to SPADA HMI

PLC	Signal Tag	Description	Range of Active State when closed	P&ID	Signal	Reck Slot	Chain Slot	Instru- ment Alarm Setpoint	Calibrate, config., and Wiring complete	PCSS I/O testing	Date	I/O Testin g to the HMI	Date	Notes
PLC-SC	LI-4000-1	Secondary Clarifier No. 1 Sludge Level	0-10 ft	8	AI	2	1	0						
PLC-SC	LI-4010-3	Secondary Clarifier No. 3 Sludge Level	0-10 ft	8	AI	2	1	1						
PLC-SC	SI-4100-1	RAAS Pump No. 1 Speed Feedback	0-100%	14	AI	2	1	2						
PLC-SC	SI-4100-4	RAAS Pump No. 4 Speed Feedback	0-100%	15	AI	2	1	3						
PLC-SC	FI-4102-1	RAAS Flow Pumps 1-3	0-1900 GPM	14	AI	2	1	4						
PLC-SC	SI-4110-1	WAS Pump No. 1 Speed Feedback	0-100%	14	AI	2	1	5						
PLC-SC	N/A	Spare Slot	N/A		Spare	2	5	N/A						
PLC-SC	SC-4100-1	RAAS Pump No. 1 Speed Setpoint	0-100%	14	AO	2	7	0						
PLC-SC	SC-4100-2	RAAS Pump No. 2 Speed Setpoint	0-100%	14	AO	2	7	1						
PLC-SC	SC-4100-3	RAAS Pump No. 3 Speed Setpoint	0-100%	14	AO	2	7	2						
PLC-SC	SC-4110-1	WAS Pump No. 1 Speed Setpoint	0-100%	14	AO	2	7	3						
PLC-SC	Spare	Spare	N/A		AO	2	7	4						
PLC-SC	Spare	Spare	N/A		AO	2	7	5						
PLC-SC	TSH-4000-1	Secondary Clarifier No. 1 High Temp	Normal	8	DI	3	1	0						
PLC-SC	XA-4000-1	Secondary Clarifier No. 1 Motor Overload	Normal	8	DI	3	1	1						
PLC-SC	WAH-4000-1	Secondary Clarifier No. 1 High Torque	Normal	8	DI	3	1	2						
PLC-SC	YRI-4000-1	Secondary Clarifier No. 1 High High Torque	Normal	8	DI	3	1	3						
PLC-SC	YRI-4000-1	Secondary Clarifier No. 1 On/Off	On	8	DI	3	1	4						
PLC-SC	YCI-4000-1	Secondary Clarifier No. 1 In Remote	In Remote	8	DI	3	1	5						
PLC-SC	YFI-4100-1	RAAS Pump No. 1 VFD Fault	Normal	14	DI	3	1	6						
PLC-SC	FAL-4100-1	RAAS Pump No. 1 Low Flow	Normal	14	DI	3	1	7						
PLC-SC	Spare	Spare	Normal	14	DI	3	1	8						
PLC-SC	YRI-4100-1	RAAS Pump No. 1 Running	Running	14	DI	3	1	9						
PLC-SC	YCI-4100-1	WAS Pump No. 1 In Remote	In Remote	14	DI	3	1	10						
PLC-SC	YFI-4110-1	WAS Pump No. 1 VFD Fault	Normal	14	DI	3	1	11						
PLC-SC	FAL-4110-1	WAS Pump No. 1 Low Flow	Normal	14	DI	3	1	12						
PLC-SC	Spare	Spare	Normal	14	DI	3	1	13						
PLC-SC	YRI-4110-1	WAS Pump No. 1 Running	Running	14	DI	3	1	14						
PLC-SC	YCI-4110-1	WAS Pump No. 1 In Remote	In Remote	14	DI	3	1	15						
PLC-SC	HSS-4000-2	Secondary Clarifier No. 2 Start Command	Start	8	DO	4	6	0						
PLC-SC	Spare	Spare	N/A		DO	4	6	1						
PLC-SC	HSS-4100-2	RAAS Pump No. 2 Start Command	Start	14	DO	4	6	2						
PLC-SC	HSS-7000-2	Sludge Holding Tank Blower No. 2 Start Command	Start	17	DO	4	6	3						
PLC-SC	HSS-4100-5	RAAS Pump No. 5 Start Command	Start	15	DO	4	6	4						
PLC-SC	Spare	Spare	N/A		DO	4	6	5						
PLC-SC	HSS-4105-1	Secondary Sludge Pump No. 2 Start/Stop	Start	15	DO	4	6	6						
PLC-SC	HSS-4110-2	WAS Pump No. 2 Start/Stop Command	Start	15	DO	4	6	7						
PLC-SC	7160-FUI-1	Sludge Loadout LCP Pumping Indicator	Pumping	17	DO	4	6	8						
PLC-SC	Spare	Spare	N/A		DO	4	6	9						
PLC-SC	HSS-7115-2	Sludge Holding Tank Mixer No. 2 Start	Start	17	DO	4	6	10						
PLC-SC	Spare	Spare	N/A		DO	4	6	11						
PLC-SC	HSS-7117-2	Sludge Holding Tank Discharge Valve No. 2 Open CMD	Open	17	DO	4	6	12						
PLC-SC	HSS-7117-2	Sludge Holding Tank Discharge Valve No. 2 Close CMD	Close	17	DO	4	6	13						
PLC-SC	HSS-7120-2	TS Transfer Pump No. 2 Start Command	Start	17	DO	4	6	14						
PLC-SC	Spare	Spare	N/A		DO	4	6	15						

**[Project Name] Appendix B - Automatic Control Strategies Sign-Off Form**

All Sections below are required to be filled out by PCSS as part of Testing  
Auto. Control Strategies - Loop operational in Automatic as defined in Control Strategies

Control Strategies Loop #	Control Strategy Description	P&ID	Auto. Control Strategy	Date	Notes
LOOP 281 - 284	LOW FLOW PUMPS	8			
LOOP 290	LOW EQ CHANNEL FLOW NO.4	8			
LOOP 300	MICROFILTRATION AIR SUPPLY LOW PRESSURE	10			
LOOP 351, 352	SITE LIFT STATION PUMP NO.1 AND NO. 2	12			
LOOP 355	SITE LIFT STATION HIGH AND LOW LEVEL CONTROL	12			
LOOP 371, 372	SLUDGE HOLDING TANK NO.1 AND NO. 2 LEVEL	14			
LOOP 381, 382	SLUDGE TRANSFER PUMPS	14			
LOOP 385	SLUDGE TRANSFER PUMPS REMOTE START/STOP COMMAND	14			
LOOP 700	EFFLUENT PUMPING STATION LEVEL	14			
LOOP 701, 702, 703	EFFLUENT PUMP NO.1	14			
LOOP 840	POST AERATION CHANNEL AIR FLOW CONTROL	15			
LOOP 900	SLUDGE TRANSFER PUMPS DISCHARGE FLOW	8			
LOOP 971	CENTRIFUGE SLUDGE FEED PUMP NO.1	8			
LOOP 1001	CENTRIFUGE NO.1 SLUDGE FEED FLOW CONTROL	8			
LOOP 1411, 1412	SODIUM HYPOCHLORITE STORAGE TANKS LEVEL	8			
LOOP 1421, 1422	SODIUM HYPOCHLORITE PUMPS	8			
LOOP 1430	SODIUM HYPOCHLORITE STORAGE TANKS CONTAINMENT AREA HIGH LEVEL DETECTION	14			
LOOP 2051, 2052, 2053	DIESEL ENGINE GENERATOR STATUS	14			
LOOP 2055	TRANSFER SWITCH STATUS	14			
LOOP 2060	GENERATOR KILOWATTS MONITORING	14			
APPENDIX ONE	EQUIPMENT RESTART DURING A POWER LOSS WITH THE GENERATOR RUNNING	14			
APPENDIX TWO	EQUIPMENT RESTART WITH POWER RESTORED AFTER A POWER LOSS	14			
N/A	SELF-HEALING CAPABILITIES OF NETWORK	N/A			
N/A	REDUNDANT SCADA SERVER FAILOVER AND RECOVERY	N/A			

## 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 process control system training for all devices and systems furnished and installed as detailed on the Drawings.
- B. Related Requirements:
  - 1. Section 13610 “Process Control and Enterprise Management Systems General Provisions.”

### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Refer to Section 13610 “Process Control and Enterprise Management Systems General Provisions.”

### 1.4 ACTION SUBMITTALS

- A. Preliminary Training Plan Submittal:
  - 1. No less than 45 days prior to startup submit outlines of each training course including course objectives and target audience, resumes of instructors, prerequisite requirements for each class, and samples of handouts for review.
- B. Final Training Plan Submittal:
  - 1. Upon receipt of Engineer's comments on preliminary training plan, submit specific proposed training plan with the following:
    - a. Definitions, objectives, and target audience of each course.
    - b. Schedule of training courses including proposed dates, duration, and locations of each class.
    - c. Complete copy of all proposed handouts and training materials bound and logically arranged with all materials reduced to a maximum size of 11 inch by 17 inch, then folded to 8.5 inch by 11 inch for inclusion into the binder.
  - 2. Submit training plan no less than 45 days prior to start of startup.

### 1.5 CLOSEOUT SUBMITTALS

- A. Refer to Section 13610 “Process Control and Enterprise Management System General Provisions.”

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Directly relate the training and instruction to the system being supplied. Training program represents a comprehensive program covering all aspects of the operation and maintenance of the system.
- B. Coordinate all training schedules with and at the convenience of Owner, including shift training required to correspond to Owner's working schedule.
- C. All onsite instructors must be intimately familiar with the operation and control of Owner's facilities.
- D. Provide detailed training manuals to supplement the training courses including specific details of equipment supplied and operations specific to the project. Provide the manuals in hardcopy for each student. Provide electronic copy of each training manual in PDF format for Owner's future use.
- E. Make use of teaching aids, manuals, or slide/video presentations as required. After training services, deliver training materials to Owner.
- F. Owner reserves the right to videotape all custom training sessions. Training tapes become sole property of Owner.
- G. Cost of Travel for off-site training:
  - 1. Cost of Travel for off-site training is paid directly by entity employing the staff doing the training.

### 3.2 TRAINING SUMMARY

- A. Provide following training courses listed in the summary table below:

Description	Minimum Course Duration (hours)	Maximum Number of Trainees per Course	Number of Times Course to be Given	Intended Audience
Installed Control System	2	2	1	Maintenance, Administrator



B. Definitions of Audience Roles:

1. Administrator: Personnel responsible for maintaining the HMI / SCADA system.
2. Maintenance: Personnel responsible for maintaining the field controller hardware and instrumentation system.
3. Operations: Personnel responsible for daily plant operations.
4. Management: Non-daily operations personnel.

3.3 ONSITE TRAINING

A. Training personnel are required to be intimately familiar with the control system equipment, its manipulation, and configuration. Training personnel are required to command knowledge of system debugging, program modification, troubleshooting, maintenance procedure, system operation, and programming, and capable of transferring this knowledge in an orderly fashion to technically oriented personnel.

B. Installed Control System Training:

1. Provide training for Owner's personnel in the functionality, maintenance, and troubleshooting, of the installed Control System. Conduct training before Functional Demonstrator Test (FDT), but not more than two months before.
2. Provide training and instruction specific to the system that is being supplied.
3. Provide training consisting of classroom instructions and hands-on instruction utilizing Owner's system.
4. Provide detailed training on the actual configuration and implementation for this Contract covering all aspects of the system that will allow Owner's personnel to maintain, modify, troubleshoot, and develop future additions/deletions to the system. Provide training covering the following subjects:
  - a. System overview.
  - b. System hardware components and specific equipment arrangements.
  - c. Periodic maintenance.
  - d. Troubleshooting and diagnosis.
  - e. Network configuration, communications, and operation.
  - f. TCP/IP addressing procedures for all Ethernet devices.

END OF SECTION 13613

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## SECTION 13614 - PROCESS CONTROL DESCRIPTIONS

### 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. Applications Engineer System Supplier (AESS) Programming Scope

1. Develop the control system applications to implement the process control descriptions for all new and existing systems. This Section is provided to define control strategies to be used for PLC programming of the system.
2. The Contract Documents are a single integrated document, and as such, all Drawings, Specifications Divisions and Specifications Sections apply. It is the responsibility of the Contractor and Subcontractors to review all Sections to ensure a complete and coordinated project.
3. The PCSS is cautioned to read this Section and all related Sections and their entirety prior to starting any programming. Many general control strategies and requirements are defined once in the body of this Section with the specific requirement called out in the individual control strategy. Implement these general strategies throughout this Contract unless specifically directed otherwise in the individual loop process control descriptions.
4. Follow loop and device tagging criteria shown on the Drawings without exception.
5. Establish programming approach and database/variable identification standards prior to performing any programming work. Review the proposed standards and conventions with the Owner during the coordination workshop.

- B. Related Requirements:

1. Section 13610 "Process Control and Enterprise Management Systems General Provisions."

#### 1.3 DEFINITIONS

- A. Applications Engineering System Supplier (AESS): The entity who provides all programming, configuration, and related services for the control system equipment provided by the PCSS.
- B. Human Machine Interface (HMI): A software-based user interface with supervisory level control of machine level equipment.
- C. Input/Output (I/O): Analog or digital field instrument signals to be received and interpreted by a PLC.
- D. Operator Interface Terminal (OIT): A hardware component of the SCADA system used for device level control and monitoring.

- E. Operator Workstation (OWS): A hardware component of the SCADA system used for supervisory level control and monitoring.
- F. Process Control System Supplier (PCSS): The entity responsible for providing all materials, equipment, labor, and services required to achieve a fully integrated and operational control system.
- G. Programmable Logic Controller (PLC): A ruggedized programmable computer used for industrial automation.
- H. Supervisor Control and Data Acquisition (SCADA): Hardware and software components used for high-level supervisory monitoring of industrial processes. Typical devices that are part of the SCADA network include computers (OWS), PLCs, Ethernet switches, OITs, and HMIs.

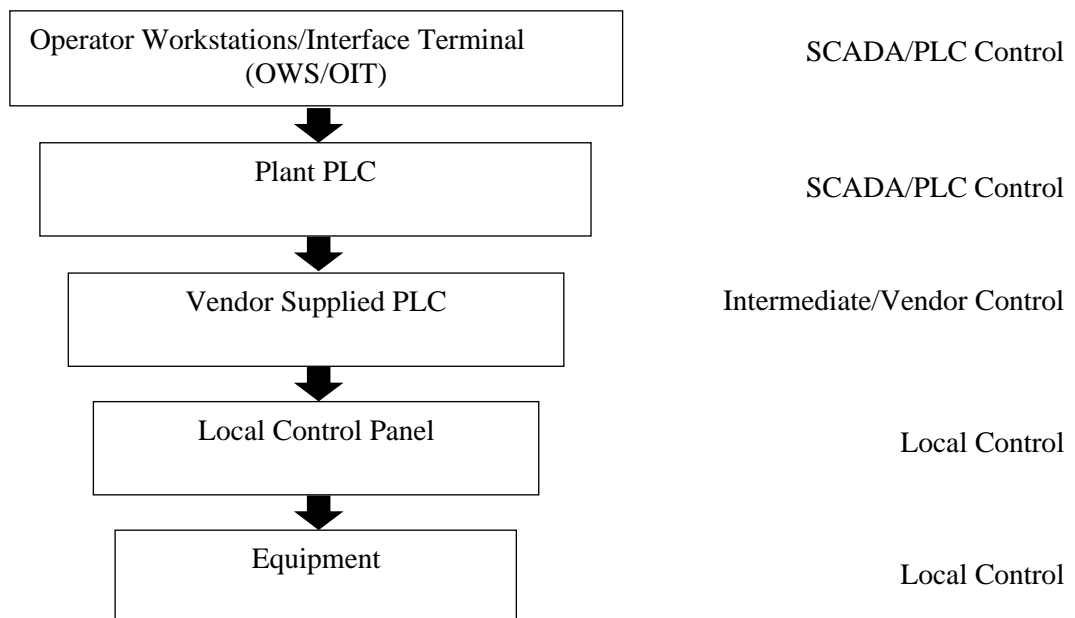
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

A. Control System Hierarchy

1. The control descriptions are broken into a hierarchical layer concept. There may be one layer or multiple layers per loop, depending upon that loop. An example of multiple layered loop is shown in Figure 1.



**Figure 1. Control System Hierarchy**

### 3.2 ALARMING AND EQUIPMENT FAILURES

#### A. Analog Alarms

1. Provide analog alarming capability for all analog signals monitored by the PLC.
2. Supervisor level users can set a common time setpoint (initially set to 5 seconds) that is used to generate alarms. The following alarms (setpoints to be Supervisor adjustable) are generated based on the analog feedback value. Each alarm includes the ability for individual enabling and disabling.
  - a. High-High
  - b. High
  - c. Low
  - d. Low-Low
  - e. Loss of Signal
3. LOSS OF SIGNAL alarm is generated when an analog signal goes outside the 4-20 mA range due to a failure at the instrument or PLC card. The following SCADA programming occurs:
  - a. If the analog signal is used in a control loop or ratio control loop, that loop is placed into MANUAL.
  - b. If the analog signal is used in a calculation, that calculation uses the last good analog signal. If the calculation is used in a control loop, that loop is placed into MANUAL.
4. SETPOINT REJECTED alarm is generated at the HMI when an analog setpoint is out of range and rejected by the PLC.

#### B. Discrete Alarms

1. Program all discrete alarm signals wired to the PLC (float switches, pressure switches, overload alarms) to alarm after an HMI adjustable time delay expires.
2. The maximum alarm delay for Safety related alarms (e.g., E-stop) is 500ms. Set each alarm timer during startup.

#### C. Motor Failure Alarms

1. Supervisor level users can set a common elapsed time setpoint for each scenario below:
  - a. Motors being remotely controlled generate a FAIL-TO-START alarm when the PLC sends the START command to the motor and it does not receive a RUNNING status from the motor after a supervisor adjustable time setpoint. When a FAIL-TO-START alarm is generated, the START output command from the PLC is deenergized and the motor is prevented from starting until a reset is issued from the HMI.
  - b. Motors being remotely controlled generate a FAIL-TO-STOP alarm when the PLC sends the STOP command to the motor, and it continues to run after a supervisor adjustable time setpoint.
  - c. Motors with adjustable speed control generate a SPEED DEVIATION alarm when the motor is running and the PLC sends a speed setpoint to the motor and it does not reach the correct speed (within a deadband, initially set to 10%) within a supervisor adjustable time setpoint. The motor remains running if the SPEED DEVIATION alarm is activated.

D. Valve Failures

1. Supervisor level users can set a common time setpoint that is used to generate the following alarms. When a valve position alarm is active, the PLC output is maintained unless explicitly stated in the individual loop descriptions (e.g., a fail to open alarm does not trigger the PLC to close the valve).
  - a. All discrete valves (OPEN-CLOSE) being remotely controlled generate a FAIL-TO-OPEN alarm when the PLC sends the OPEN command to the valve, and it does not reach the OPENED limit within a supervisor adjustable time setpoint.
  - b. All discrete valves (OPEN-CLOSE) being remotely controlled generate a FAIL-TO-CLOSE alarm when the PLC sends the CLOSE command to the valve, and it does not reach the CLOSED limit within a supervisor adjustable time setpoint.
  - c. All modulating valves (POSITIONING) being remotely controlled generate a FAIL-TO-POSITION alarm when the valve feedback does not match the PLC commanded position within a supervisor adjustable time setpoint.

3.3 INDIVIDUAL CONTROL DESCRIPTIONS AND CONTROL SEQUENCES

LOOP 4010-01, 4010-02 SUPPLY FAN DIFFERENTIAL PRESSURE HIGH ALARM

A. General

1. A filter will be provided at each supply fan and the differential pressure across the filter will be monitored for high alarm condition.

B. Control

1. None.

C. Alarms/Monitoring

1. High differential pressure across the filter will be alarmed at the HMI to indicate clogged filter.

D. Data Collection:

1. None

LOOP 4011-01, 4011-02 BLOWER ROOM TEMPERATURE HIGH ALARM

A. General

1. A high temperature switches will be provided in each blower room to monitor the temperature inside the room. The switch will alarm when the temperature inside the room is above a preset value.

B. Control

1. None.

C. Alarms/Monitoring

1. High temperature inside each blower room will be alarmed at the HMI.

D. Data Collection:

1. None

LOOP 4000-01A, 4000-02A, 4000-03A, 4000-04A, 4000-05A, 4000-06A, 4000-07A BLOWER CONTROLS CABINET COOLING FILTER HIGH DIFFERENTIAL PRESSURE ALARM

4000-01, 4000-02, 4000-03, 4000-04, 4000-05, 4000-06, 4000-07 BLOWER PROCESS AIR INTAKE FILTER HIGH DIFFERENTIAL PRESSURE ALARM

A. General

1. Each blower will be provided with a new Controls Cabinet Cooling Filter. The existing differential pressure switch located on the Cooling Air Intake filter will be relocated to the Controls Cabinet Cooling Filter. High differential pressure across the filter will be alarmed when the pressure goes above a value set at the instrument.
2. The existing differential pressure switch on the Process Air Intake filter will be relocated on the filter in the Process Air Intake Plenum Box. High differential pressure across the filter will be alarmed when the pressure goes above a value set at the instrument.

B. Control

1. None.

C. Alarms/Monitoring

1. High pressure signal across Control Cabinet Cooling Filter for each Blower
2. High pressure signal across Process Air Intake Plenum Box for each Blower

D. Data Collection:

1. None

END OF SECTION 13614

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## SECTION 15042 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

### 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 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.

#### 1.3 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.
- B. Comply with IEEE 841 for severe-duty motors.

#### 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. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. 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.
- K. 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:
  - 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.
  - 5. Provide grounding rings or straps on motors with variable frequency controller.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

## 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 USED)

END OF SECTION 15042

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## SECTION 15061 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

### 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 pipe hangers and supports.
2. Metal framing systems.
3. Trapeze pipe hangers.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

- B. Related Requirements:

1. Section 05502 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 15712 "Metal Ducts" for duct hangers and supports.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 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. 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.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

### 2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anvil.
  - b. Atkore International.
  - c. Eaton (B-line).
2. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
4. Channels: Continuous slotted channel with inturred lips.
5. Channel Width: Selected for applicable load criteria.

6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer.
8. Metallic Coating: Hot-dip galvanized.
9. Channel pipe clamp: Metal pipe clamp to support the pipe from the channel.
10. Cushioned pipe clamp: Metal pipe clamp with an integral plastic liner.
11. Insulation clamp: Metal pipe clamp with integral plastic tabs to center the pipe within the clamp.
12. Post base: Metal base to support a vertical channel.

#### 2.4 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.

#### 2.5 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Buckaroos, Inc.
  2. Carpenter & Paterson, Inc.
  3. KB Enterprise.
  4. National Pipe Hanger Corporation.
  5. Pipe Shields Inc.
  6. Piping Technology & Products, Inc.
  7. Rilco Manufacturing Co., Inc.
  8. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psi or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psi or ASTM C 552, Type II cellular glass with 100-psi or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hilti, Inc.
    - b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
    - c. MKT Fastening, LLC.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. B-Line; a division of Eaton, Electrical Sector.
    - b. Empire Industries, Inc.
    - c. Hilti, Inc.
    - d. ITW Ramset/Red Head; Illinois Tool Works, Inc.
    - e. MKT Fastening, LLC.
  2. Indoor Applications: Zinc-coated or stainless-steel.
  3. Outdoor Applications: Stainless steel.

## 2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.8 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; 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 07841 "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. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. 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.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. 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.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.

- I. 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.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. 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.
- L. 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. 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 metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. 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. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  - 5. 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.
  - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. 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.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. 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.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
  - a. Horizontal (MSS Type 54): Mounted horizontally.
  - b. Vertical (MSS Type 55): Mounted vertically.
  - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 15061

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## SECTION 15091 - DUCT INSULATION

### 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 insulating the following duct services:
  - 1. Indoor, exposed supply and outdoor air.
  - 2. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

#### 1.3 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 15061 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### 1.4 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having

jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA.
    - b. Armacell LLC.
    - c. K-Flex USA.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller.
    - d. Mon-Eco Industries, Inc.
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller.
    - d. Mon-Eco Industries, Inc.

## 2.3 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Foster Brand; H. B. Fuller.
    - c. Knauf Insulation.
    - d. Vimasco Corporation.
  - 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
  - 5. Color: White.

## 2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Childers Brand; H. B. Fuller Construction Products.
  - b. Eagle Bridges - Marathon Industries.
  - c. Foster Brand; H. B. Fuller.
  - d. Mon-Eco Industries, Inc.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Childers Brand; H. B. Fuller Construction Products.
  - b. Foster Brand; H. B. Fuller.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

## 2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
  4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.
  5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Childers Brand; H. B. Fuller Construction Products.
  - b. Foster Brand; H. B. Fuller.
- B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Foster Brand; H. B. Fuller.
    - c. Vimasco Corporation.

## 2.7 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Alpha Associates, Inc.

## 2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Industrial Adhesives and Tapes Division.
    - b. Avery Dennison Corporation, Specialty Tapes Division.
    - c. Ideal Tape Co., Inc., an American Biltrite Company.
    - d. Knauf Insulation.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Industrial Adhesives and Tapes Division.
    - b. Avery Dennison Corporation, Specialty Tapes Division.

- c. Ideal Tape Co., Inc., an American Biltrite Company.
  - d. Knauf Insulation.
2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
  2. Width: 2 inches.
  3. Thickness: 3.7 mils.
  4. Adhesion: 100 ounces force/inch in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch in width.

## 2.9 SECUREMENTS

### A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Johns Manville; a Berkshire Hathaway company.
  - b. RPR Products, Inc.
2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

### B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) AGM Industries, Inc.
    - 2) Gemco.
    - 3) Midwest Fasteners, Inc.
    - 4) Nelson Stud Welding.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) AGM Industries, Inc.
    - 2) CL WARD & Family Inc.
    - 3) Gemco.
    - 4) Midwest Fasteners, Inc.
    - 5) Nelson Stud Welding.
  
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) AGM Industries, Inc.
    - 2) Gemco.
    - 3) Midwest Fasteners, Inc.
  
  - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Stainless steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
  
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Gemco.
    - 2) Midwest Fasteners, Inc.
  
  - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
  - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) AGM Industries, Inc.
      - 2) Gemco.
      - 3) Midwest Fasteners, Inc.
    - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    - c. Spindle: Stainless steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
    - d. Adhesive-backed base with a peel-off protective cover.
  6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) AGM Industries, Inc.
      - 2) Gemco.
      - 3) Midwest Fasteners, Inc.
      - 4) Nelson Stud Welding.
    - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
  7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Gemco.
      - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. C & F Wire Products.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. RPR Products, Inc.



## 2.10 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
  2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
  2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.

- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
  - 1. Comply with requirements in Section 07841 "Penetration Firestopping."

### 3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not over compress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch

o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
- b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
  - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not over compress insulation during installation.
  - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

- b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
- 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.6 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09912 "Interior Painting."
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Engineer. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Inspect ductwork, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.8 DUCT INSULATION SCHEDULE, GENERAL

#### A. Plenums and Ducts Requiring Insulation:

1. Indoor, exposed supply and outdoor air.

#### B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.
8. Exposed ductwork located in the area it serves.
9. Return air ductwork located in return air ceiling spaces above the area it serves, except where the return ductwork is installed in ceiling spaces with a roof above.

### 3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

#### A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1 inches thick and 0.75-lb/cu. ft. nominal density.

### 3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

#### A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

#### B. If more than one material is listed, selection from materials listed is Contractor's option.

#### C. Ducts and Plenums, Exposed:

1. None.
2. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 15091

## SECTION 15712 - METAL DUCTS

### 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. Single-wall rectangular ducts and fittings.
- 2. Single-wall round ducts and fittings.
- 3. Sheet metal materials.
- 4. Sealants and gaskets.
- 5. Hangers and supports.

- B. Related Sections:

- 1. Section 15905 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
- 2. Section 15715 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### 1.3 DEFINITIONS

- A. OSHPD: Office of Statewide Health Planning and Development (State of California).

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:

- 1. Liners and adhesives.
- 2. Sealants and gaskets.

- B. Sustainable Design Submittals:

- 1. Product Data: For adhesives, indicating VOC content.
- 2. Product Data: For sealants, indicating VOC content.

- C. Shop Drawings:

- 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top and bottom of ducts.
5. Dimensions of all duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Welding certificates.
- C. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
  1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
- B. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- E. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.



## 2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
1. Construct ducts of aluminum unless otherwise indicated.
  2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
  2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
1. Construct ducts of aluminum unless otherwise indicated.
  2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
  3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Elgen Manufacturing.
    - b. GreenSeam.
    - c. Linx Industries; a DMI company (formerly Lindab).
    - d. MKT Metal Manufacturing.

- e. McGill AirFlow LLC.
  - f. Nordfab Ducting.
  - g. SEMCO, LLC; part of FlaktGroup.
  - h. SHAPE Manufacturing Inc.
  - i. Set Duct Manufacturing.
  - j. Sheet Metal Connectors, Inc.
  - k. Spiral Manufacturing Co., Inc.
  - l. Stamped Fittings Inc.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
  - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.4 SHEET METAL MATERIALS

- A. General Material Requirements: 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.
- B. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- C. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. 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.

## 2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
  1. Application Method: Brush on.
  2. Solids Content: Minimum 65 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. Flanged Joint Sealant: Comply with ASTM C920.
  1. General: Single-component, acid-curing, silicone, elastomeric.
  2. Type: S.
  3. Grade: NS.
  4. Class: 25.
  5. Use: O.
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- E. Round Duct Joint O-Ring Seals:
  1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
  2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports:
  - 1. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- J. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation.

- L. Elbows: Use long-radius elbows wherever they fit.
- M. Branch Connections: Use lateral or conical branch connections.

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCTWORK EXPOSED TO WEATHER

- A. All external joints are to be welded or have secure watertight mechanical connections. Seal all openings to provide weatherproof construction.
- B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.
- C. Single Wall:
  - 1. Ductwork shall be aluminum.
  - 2. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 15091 "Duct Insulation."

### 3.4 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
  2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
  5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 15715 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.7 STARTUP

- A. Air Balance: Comply with requirements in Section 15905 "Testing, Adjusting, and Balancing for HVAC."

### 3.8 DUCT SCHEDULE

- A. Refer to the Drawings for the Duct Schedule.
- B. Elbow Configuration:
  1. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
    - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

- 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
- 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
- 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
- 4) Radius-to Diameter Ratio: 1.5.

- b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
- c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

C. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
  - a. Rectangular Main to Rectangular Branch: 45-degree entry.
  - b. Rectangular Main to Round Branch: Conical spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
  - a. Velocity 1000 fpm or Lower: 90-degree tap.
  - b. Velocity 1000 to 1500 fpm: Conical tap.
  - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 15712

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## SECTION 15715 - AIR DUCT ACCESSORIES

### 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. Barometric relief dampers.
  - 2. Return Air Grille
- B. Related Requirements:
  - 1. N/A.

#### 1.3 ACTION SUBMITTALS

- A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
  - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.
    - b. Manual volume damper installations.
    - c. Control-damper installations.
    - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
    - e. Duct security bars.
    - f. Wiring Diagrams: For power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

## 1.6 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

## PART 2 - PRODUCTS

### 2.1 BAROMETRIC RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Warming and Ventilating (AWV); Mestek, Inc.
  - 2. Cesco Products; MESTEK, Inc.
  - 3. Greenheck Fan Corporation.
  - 4. Lloyd Industries, Inc.
  - 5. NCA Manufacturing, Inc.; Metal Industries, Inc.
  - 6. Nailor Industries Inc.
  - 7. Pottorff.
  - 8. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
  - 9. Safe Air - Dowco.
  - 10. United Enertech Corp.
  - 11. Vent Products Co., Inc.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 1000 fpm.
- D. Maximum System Pressure: 1-inch wg.
- E. Frame: Flanged on the discharge, 0.05-inch-thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.
- F. Blades: Multiple single-piece blades, end pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Neoprene, mechanically locked.

- I. Blade Axles:
  - 1. Material: Plated steel.
  - 2. Diameter: 0.063 inch.
- J. Tie Bars and Brackets: Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Accessories:
  - 1. Adjustment device to permit setting for varying differential static pressure.
  - 2. Counterweights and spring-assist kits for vertical airflow installations.
  - 3. Electric actuators.
  - 4. Chain pulls.
  - 5. Screen Mounting: Front mounted in sleeve.
    - a. Sleeve Thickness: 20 gauge minimum.
    - b. Sleeve Length: 6 inches minimum.
  - 6. Screen Mounting: Rear mounted.
  - 7. Screen Material: Galvanized steel.
  - 8. Screen Type: Insect.
  - 9. 90-degree stops.

## 2.2 RETURN AIR GRILLES

- A. Return Air Register::
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anemostat.
    - b. METALAIRE, Inc..
    - c. Price Industries Inc..
    - d. Titus.
    - e. Nailor Industries Inc.
  - 2. Frame : Left hinged aluminum frame.
  - 3. Blades: Aluminum louvered with 35 degrees fixed deflection
  - 4. Blades Spacing: 3/4-inch
  - 5. Blades Arrangement: Front blades parallel to longer dimension.:
  - 6. Finish: Standard.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Set dampers to fully open position before testing, adjusting, and balancing.
- D. Install duct security bars. Construct duct security bars from 0.164-inch steel sleeve, continuously welded at all joints and 1/2-inch-diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.
- E. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.

END OF SECTION 15715

## SECTION 15724 - HVAC POWER VENTILATORS

### 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. Sidewall propeller fans.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
  - 2. Rated capacities, operating characteristics, and furnished specialties and accessories.
  - 3. Certified fan performance curves with system operating conditions indicated.
  - 4. Certified fan sound-power ratings.
  - 5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 6. Material thickness and finishes, including color charts.
  - 7. Dampers, including housings, linkages, and operators.
  - 8. Prefabricated roof curbs.
  - 9. Fan speed controllers.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, 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.
  - 4. Design Calculations: Calculate requirements for selecting vibration isolators.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For HVAC power ventilators to include in normal and emergency, operation, and maintenance manuals.

## 1.5 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. Belts: One set(s) for each belt-driven unit.

## PART 2 - PRODUCTS

### 2.1 SIDEWALL PROPELLER FANS

- A. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring, with baked-enamel finish coat applied after assembly.
- B. Fan Wheel: Replaceable, cast or extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
- C. Fan Drive:
  - 1. Belt drive.
  - 2. Resiliently mounted to housing.
  - 3. Statically and dynamically balanced.
  - 4. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
  - 5. Extend grease fitting to accessible location outside of unit.
  - 6. Service Factor Based on Fan Motor Size: 1.4.
  - 7. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
  - 8. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
    - a. Ball-Bearing Rating Life: ABMA 9.
  - 9. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
  - 10. 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.
  - 11. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
  - 12. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
- D. Accessories:
  - 1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
  - 2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
  - 3. Wall Sleeve: Galvanized steel to match fan and accessory size.

### 2.2 MOTORS

- A. Enclosure: TEFC

- B. Service Factor: 1.15.
- C. Insulation Class: F
- D. Efficiency: NEMA Premium.
- E. 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.

### 2.3 SOURCE QUALITY CONTROL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. AMCA Certification: Fans shall comply with AMCA 11 and bear the AMCA-Certified Ratings Seal.
- C. Fan Sound Ratings: Comply with AMCA 311, and label fans with the AMCA-Certified Ratings Seal. Sound ratings shall comply with AMCA 301. The fans shall be tested according to AMCA 300.
- D. Fan Performance Ratings: Comply with AMCA 211 and label fans with AMCA-Certified Rating Seal. The fans shall be tested for air performance - flow rate, fan pressure, power, fan efficiency, air density, speed of rotation, and fan efficiency - according to AMCA 210/ASHRAE 51.
- E. Operating Limits: Classify according to AMCA 99.
- F. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF HVAC POWER VENTILATORS

- A. Install power ventilators level and plumb.
- B. Equipment Mounting:
  - 1. Install power ventilators on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03300 "Cast-in-Place Concrete."
- C. Install units with clearances for service and maintenance.
- D. Label units according fan schedule on drawings. to requirements specified in Section 15065 "Identification for HVAC Piping and Equipment."

### 3.2 DUCTWORK CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 15715 "Air Duct Accessories."

### 3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 16052 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 16056 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
  - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 16070 "Identification for Electrical Systems."
  - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

### 3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

### 3.5 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. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
- E. 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 there is adequate maintenance and access space.
  - 4. Verify that cleaning and adjusting are complete.
  - 5. 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.
  - 6. Adjust belt tension.



7. Verify lubrication for bearings and other moving parts.
  8. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  9. Shut unit down and reconnect automatic temperature-control operators.
  10. Remove and replace malfunctioning units and retest as specified above.
- F. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports.

### 3.6 ADJUSTING

- A. Adjust belt tension.
- B. Comply with requirements in Section 15905 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- C. Replace fan and motor pulleys as required to achieve design airflow.
- D. Lubricate bearings.

### 3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain propeller fans.

END OF SECTION 15724

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## SECTION 15806 - PACKAGED TERMINAL AIR-CONDITIONERS, OUTDOOR, WALL-MOUNTED UNITS

### 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 packaged, terminal, outdoor, wall-mounted air conditioners.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For packaged, terminal air conditioners.
  - 1. Include plans, elevations, sections, details for wall penetrations, and attachments to other work.
  - 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. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For packaged, terminal air conditioners, for tests performed by manufacturer and witnessed by a qualified testing agency.
- B. Field quality-control reports.
- C. Sample Warranty: For special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged, terminal air conditioners to include in emergency, operation, and maintenance manuals.

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of packaged, terminal air conditioners that fail in materials or workmanship within specified warranty period.
1. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five years from date of Substantial Completion, including components and labor.
  2. Warranty Period for Nonsealed System Parts: Manufacturer's standard, but not less than five years from date of Substantial Completion, including only components and excluding labor.
  3. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
  4. Warranty Period for Energy Recovery Ventilator: Manufacturer's standard, but not less than five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bard Manufacturing Company.
  2. Compu-Aire, Inc.
  3. Liebert; Vertiv Holdings Co.
  4. Marvair.

### 2.2 MANUFACTURED UNITS

- A. Description: Factory-assembled and -tested, self-contained, packaged, terminal air conditioner with room cabinet, electric refrigeration system, and temperature controls; fully charged with refrigerant and filled with oil; with hardwired chassis and circuit breaker.
- 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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."
- D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
- E. ASHRAE Thermal Comfort: Applicable requirements in ASHRAE 55.
- F. ASHRAE ERV Testing: Applicable requirements in ASHRAE 84.
- G. AHRI Rating: Applicable requirements in AHRI 1060.
- H. UL listed and ETL performance certified.

## 2.3 CHASSIS

- A. Cabinet: Sloped top, 16 gauge galvanized steel with factory provided gold corrosion resistant coating and removable front panel with concealed latches.
1. Mounting: On exterior wall.
  2. Discharge Grille: Extruded-aluminum discharge grille.
  3. Return Grille: Extruded-aluminum grille.
  4. Louvers: Extruded aluminum with enamel finish; color.
  5. Finish: Baked enamel.
  6. Access Door: Hinged door in top of cabinet for access to controls.
  7. Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.
  8. Insulation: Cooling and heating sections fully insulated with 1-inch-thick fiberglass insulation.
  9. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- B. Dual Refrigeration System: Direct-expansion indoor coils with capillary restrictor and hermetically sealed with dual independent scroll compressors with liquid line filter dryer, externally equalized expansion valve, high-pressure switch, low-pressure switch, fan cycle, control, common alarm, vibration isolation, and overload protection.
1. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins.
  2. Accumulator.
  3. Constant-pressure expansion valve.
  4. Reversing valve.
  5. Charge: R-410A.
- C. Indoor Fan: Backward Inclined, centrifugal; with variable-speed motor(s) and positive-pressure ventilation damper with concealed manual operator.
- D. Filters: 2-inch, pleated, disposable MERV 8, serviceable from front of the unit.
- E. Condensate Drain: Coated galvanized-steel drain pan.
1. Comply with ASHRAE 62.1 for drain pan construction and connections.
- F. Outdoor Fan: Propeller type with separate motor.
1. Indoor and Outdoor Fan Motors: Variable speed; comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 15042 "Common Motor Requirements for HVAC Equipment."
    - a. Fan Motors: Permanently lubricated split capacitor.
    - b. 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.
    - c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

## 2.4 CONTROLS

- A. Control Module: Unit-mounted digital panel with touchpad temperature control and with touchpad for heating, cooling, and fan operation. Include the following features:
  - 1. Low-Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg F outdoor air temperature.
  - 2. Temperature-Limit Control: Prevents occupant from exceeding preset setup temperature.
  - 3. Building Automation System Interface: Allows remote on-off control with setback temperature control.
- B. AC unit manufacturer provided Lead/Lag Controller: Lead-Lag alternation functionality of minimum four AC units, independent control of AC units in multiple zones, illuminated interface buttons, backlit display. Basis of design is Bard LC6000.

## 2.5 CAPACITIES AND CHARACTERISTICS

- A. Refer to Schedule on Drawings.

## 2.6 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Factory test to comply with AHRI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."
- B. Unit Performance Ratings: Factory test to comply with AHRI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.
- B. Install wall sleeves in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 07920 "Joint Sealants."
- C. Install and anchor wall sleeves to withstand, without damage to equipment and structure, seismic forces required by building code.

### 3.2 CONNECTIONS

- A. Install piping adjacent to machine to allow service and maintenance.

### 3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
  - 2. After installing packaged, terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
  - 3. Unit is level on base and is flashed in exterior wall.
  - 4. Unit casing has no visible damage.
  - 5. Compressor, air-cooled condenser coil, and fans have no visible damage.
  - 6. Labels are clearly visible.
  - 7. Controls are connected and operable.
  - 8. Shipping bolts, blocks, and tie-down straps are removed.
  - 9. Filters are installed and clean.
  - 10. Drain pan and drain line are installed correctly.
  - 11. Electrical wiring installation complies with manufacturer's submittal and installation requirements in electrical Sections.
  - 12. Installation: Perform startup checks according to manufacturer's written instructions, including the following:
    - a. Lubricate bearings on fan.
    - b. Check fan-wheel rotation for correct direction without vibration and binding.
  - 13. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 14. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. After performance test, change filters.
- E. Packaged, terminal air conditioners will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

### 3.4 ADJUSTING

- A. Adjust initial temperature set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain packaged, terminal air conditioners.

END OF SECTION 15806



## SECTION 15905 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

### 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. Balancing Air Systems:
    - a. Constant-volume air systems.
  - 2. Testing, Adjusting, and Balancing Equipment:
    - a. Motors.

#### 1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.
- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.

#### 1.4 PREINSTALLATION MEETINGS

- A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
  - 1. Minimum Agenda Items:
    - a. The Contract Documents examination report.

- b. The TAB plan.
- c. Needs for coordination and cooperation of trades and subcontractors.
- d. Proposed procedures for documentation and communication flow.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. 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.
- D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

## 1.6 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. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

## 1.7 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## PART 2 - PRODUCTS (NOT USED)

## 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 installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. 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.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. 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.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.

- I. 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.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible, and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. 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 the following:
  - 1. Equipment and systems to be tested.
  - 2. Strategies and step-by-step procedures for balancing the systems.
  - 3. Instrumentation to be used.
  - 4. Sample forms with specific identification for all equipment.
- 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. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
    - b. Duct systems are complete with terminals installed.
    - c. Volume, smoke, and fire dampers are open and functional.
    - d. Clean filters are installed.
    - e. Fans are operating, free of vibration, and rotating in correct direction.
    - f. Variable-frequency controllers' startup is complete, and safeties are verified.
    - g. Automatic temperature-control systems are operational.
    - h. Ceilings are installed.
    - i. Windows and doors are installed.
    - j. 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" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 15715 "Air Duct Accessories."
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 15091 "Duct Insulation," Section 15092 "HVAC Equipment Insulation," and Section 15093 "HVAC Piping Insulation."
- C. 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.
- D. 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 15712 "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 outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air 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.
    - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
  - 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. Obtain approval from Engineer or Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  - 5. 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.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

### 3.6 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

### 3.7 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

### 3.8 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
  - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
  - 2. Air Outlets and Inlets: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### 3.9 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. Pump curves.
  - 2. Fan curves.
  - 3. Manufacturers' test data.
  - 4. Field test reports prepared by system and equipment installers.
  - 5. 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. Engineer'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. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Water and steam flow rates.
  3. Duct, outlet, and inlet sizes.
  4. Pipe and valve sizes and locations.
  5. Terminal units.
  6. Balancing stations.
  7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.
    - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    - j. Number, make, and size of belts.
    - k. Number, type, and size of filters.
  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.
  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. Filter static-pressure differential in inches wg.
- f. Preheat-coil static-pressure differential in inches wg.
- g. Cooling-coil static-pressure differential in inches wg.
- h. Heating-coil static-pressure differential in inches wg.
- i. Outdoor airflow in cfm.
- j. Return airflow in cfm.
- k. Outdoor-air damper position.
- l. Return-air damper position.
- m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch o.c.
- f. Make and model number.
- g. Face area in sq. ft.
- h. Tube size in NPS.
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig.
- n. Refrigerant suction temperature in deg F.
- o. Inlet steam pressure in psig.

G. Fan Test Reports: For supply, return, and exhaust 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.
- H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft.
    - g. Indicated airflow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual airflow rate in cfm.
    - j. Actual average velocity in fpm.
    - k. Barometric pressure in psig.
- I. Air-Terminal-Device Reports:
1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Apparatus used for test.

- d. Area served.
  - e. Make.
  - f. Number from system diagram.
  - g. Type and model number.
  - h. Size.
  - i. Effective area in sq. ft.
2. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm.
    - b. Air velocity in fpm.
    - c. Preliminary airflow rate as needed in cfm.
    - d. Preliminary velocity as needed in fpm.
    - e. Final airflow rate in cfm.
    - f. Final velocity in fpm.
    - g. Space temperature in deg F.
- J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
    - a. System and air-handling-unit identification.
    - b. Location and zone.
    - c. Room or riser served.
    - d. Coil make and size.
    - e. Flowmeter type.
  2. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm.
    - b. Entering-water temperature in deg F.
    - c. Leaving-water temperature in deg F.
    - d. Water pressure drop in feet of head or psig.
    - e. Entering-air temperature in deg F.
    - f. Leaving-air temperature in deg F.

### 3.10 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Owner and Construction Manager.
- B. Engineer, Owner, or Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
  - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
  - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
  - 3. If the second verification also fails, Owner or Engineer may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- F. Prepare test and inspection reports.

### 3.11 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 15905

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## SECTION 15933 - PRESSURE INSTRUMENTS

### 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. Air-pressure switches.
- B. Related Requirements:

#### 1.3 DEFINITIONS

- A. HART: Highway addressable remote transducer protocol is the global standard for sending and receiving digital information across analog wires between smart devices and control or monitoring systems through bi-directional communication that provides data access between intelligent field instruments and host systems. A host can be any software application from technician's hand-held device or laptop to a control, asset management, safety, or other system using any control platform.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:
  - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Operating characteristics; electrical characteristics; and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
  - 3. Product description with complete technical data, performance curves, and product specification sheets.
  - 4. Installation instructions, including factors affecting performance.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and mounting details.

2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Number-coded identification system for unique identification of wiring, cable, and tubing ends.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plan drawings and corresponding product installation 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. Product installation location shown in relationship to room, duct, pipe, and equipment.
  2. Wall-mounted instruments located in finished space, showing relationship to light switches, fire alarm devices, and other installed devices.
  3. Size and location of wall access panels for instruments installed behind walls.
  4. Size and location of ceiling access panels for instruments installed in accessible ceilings.
- B. Product Certificates: For each product requiring a certificate.
- C. Product Test Reports: For each product requiring test performed by manufacturer and witnessed by a qualified testing agency.
- D. Source quality-control reports.
- E. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For instruments to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Environmental Conditions:
  1. Instruments shall operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.
    - a. If instrument alone cannot comply with requirement, install instrument in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated and cooled, filtered, and ventilated as required by instrument and application.



2. Instruments and accessories shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Instruments not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures. Instrument-installed location shall dictate following NEMA 250 enclosure requirements:
  - a. Indoors, Heated and Air-Conditioned: Type 1.

## 2.2 AIR-PRESSURE SWITCHES

### A. Air-Pressure Differential Switch with Adjustable Set Point:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Cleveland control AFS-262 or Equal.
  2. Diaphragm operated to actuate an SPDT snap switch.
  3. Electrical Connections: Screw terminals.
  4. Enclosure Conduit Connection: Knock out or threaded connection.
  5. User Interface: Set point adjustment by adjusting screw.
  6. High and Low Process Connections: Nuts and Self aligning ferrules.
  7. Enclosure: NEMA 1
8. Operating Data:
  - a. Electrical Rating: 300 VA pilot duty at 115 to 277 VAC.
  - b. Set Point Range: 0.05 +/- 0.02" W.C. to 2.0" W.C.
  - c. Differential Pressure Range: 0.02 +/- 0.01" W.C. to 0.1" W.C.
  - d. Maximum Pressure Range: 0.05 psi.
  - e. Temperature Limits: Minus 40 deg F to 185 deg F.

## 2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled pressure instruments, as indicated by instrument requirements. Affix standards organization's certification and label.
- B. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates 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 instruments installed in piping to verify actual locations of connections before installation.
- C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PRESSURE INSTRUMENT APPLICATIONS

#### A. Air-Pressure Differential Switches:

1. System,: Air-pressure differential switch with adjustable set point.

### 3.3 INSTALLATION, GENERAL

- A. Install products level, plumb, parallel, and perpendicular with building construction.
- B. Properly support instruments, tubing, piping wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement, sway, or a break in attachment when subjected to a force.
- C. Provide ceiling, floor, roof, wall openings, and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.
- D. Fastening Hardware:
  1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
  2. Tighten bolts and nuts firmly and uniformly. Do not to overstress threads by using excessive force or oversized wrenches.
  3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.
- E. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.
- F. Corrosive Environments:
  1. Use products that are suitable for environment to which they are subjected.
  2. If possible, avoid or limit use of materials in corrosive environments.
  3. When conduit is in contact with a corrosive environment, use Type 316 stainless-steel conduit and fittings or conduit and fittings that are coated with a corrosive-resistant coating that is suitable for environment.

4. Where instruments are located in a corrosive environment and are not corrosive resistant from the manufacturer, field install products in a NEMA 250, Type 4X enclosure constructed of Type 316L stainless steel.

### 3.4 ELECTRICAL POWER

- A. Furnish and install electrical power to products requiring electrical connections.
- B. Furnish and install circuit breakers. Comply with requirements in Section 16286 "Enclosed Switches and Circuit Breakers."
- C. Furnish and install power wiring. Comply with requirements in Section 16052 "Low-Voltage Electrical Power Conductors and Cables."
- D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

### 3.5 PRESSURE INSTRUMENT INSTALLATION

- A. Mounting Location:
  1. Rough-in: Outline instrument-mounting locations before setting instruments and routing, cable, wiring, tubing, and conduit to final location.
  2. Install switches and transmitters for air and liquid pressure associated with individual air-handling units and associated connected ductwork and piping near air-handlings units co-located in air-handling unit system control panel, to provide service personnel a single and convenient location for inspection and service.
  3. Install liquid and steam pressure switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
  4. Install air-pressure switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
  5. Mount switches and transmitters not required to be mounted within system control panels on walls, floor-supported freestanding pipe stands, or floor-supported structural support frames. Use manufacturer mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.
- B. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static pressure class and leakage and seal classes indicated using neoprene gaskets or grommets.
- C. Duct Pressure Sensors:
  1. Install sensors using manufacturer's recommended upstream and downstream distances.
  2. Unless indicated on Drawings, locate sensors approximately 50 percent of distance of longest hydraulic run. Location of sensors shall be submitted and approved before installation.
  3. Install mounting hardware and gaskets to make sensor installation airtight.
  4. Route tubing from the sensor to transmitter.

5. Use compression fittings at terminations.
6. Install sensor in accordance with manufacturer's instructions.
7. Support sensor to withstand maximum air velocity, turbulence, and vibration encountered to prevent instrument failure.

D. Air-Pressure Differential Switches:

1. Install air-pressure sensor in system for each switch connection. Install sensor in an accessible location for inspection and replacement.
2. A single sensor may be used to share a common signal to multiple pressure instruments.
3. Install access door in duct and equipment to access sensors that cannot be inspected and replaced from outside.
4. Route NPS 3/8 tubing from sensor to switch connection.
5. Do not mount switches on rotating equipment.
6. Install switches in a location free from vibration, heat, moisture, or adverse effects, which could damage the switch and hinder accurate operation.
7. Install switches in an easily accessible location serviceable from floor.
8. Install switches adjacent to system control panel if within [**50 feet**]; otherwise, locate switch in vicinity of system connection.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 16070 "Identification for Electrical Systems."
- B. Install engraved phenolic nameplate with instrument identification.

### 3.7 CHECKOUT PROCEDURES

- A. Check out installed products before continuity tests, leak tests, and calibration.
- B. Check instruments for proper location and accessibility.
- C. Check instruments for proper installation with respect to direction of flow, elevation, orientation, insertion depth, or other applicable considerations that impact performance.

### 3.8 ADJUSTMENT, CALIBRATION, AND TESTING

- A. Description:
  1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
  2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
  3. For each analog instrument, perform a three-point calibration test for both linearity and accuracy.

4. Equipment and procedures used for calibration shall comply with instrument manufacturer's recommendations.
5. Provide diagnostic and test equipment for calibration and adjustment.
6. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
8. If, after calibration, indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures indicated by ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

D. Sensors: Check sensors at zero, 50, and 100 percent of project design values.

E. Switches: Calibrate switches to make or break contact at set points indicated.

F. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of project design values.

### 3.9 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

### 3.10 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include six months' full maintenance by skilled employees of systems and equipment Installer. Include annual preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain instrumentation and control devices.

END OF SECTION 15933

## SECTION 15935 - TEMPERATURE INSTRUMENTS

### 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. Air temperature sensors.
  - 2. Air temperature switches.

#### 1.3 DEFINITIONS

- A. HART (Highway Addressable Remote Transducer) Protocol: The global standard for sending and receiving digital information across analog wires between smart devices and control or monitoring systems through bidirectional communication that provides data access between intelligent field instruments and host systems. A host can be any software application from a technician's hand-held device or laptop to a plant's process control, asset management, safety, or other system using any control platform.
- B. RTD: Resistance temperature detector.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:
  - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
  - 3. Product description with complete technical data, performance curves, and product specification sheets.
  - 4. Installation operation and maintenance instructions, including factors affecting performance.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and details.

2. Include details of product 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.
4. Include number-coded identification system for unique identification of wiring, cable, and tubing ends.

C. Samples: For each exposed product installed in finished space.

## 1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plan drawings and corresponding product installation 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. Product installation location shown in relationship to room, duct, pipe, and equipment.
2. Wall-mounted instruments located in finished space showing relationship to light switches, fire-alarm devices, and other installed devices.
3. Sizes and locations of wall access panels for instruments installed behind walls.
4. Sizes and locations of ceiling access panels for instruments installed in inaccessible ceilings.

B. Product Certificates: For each product requiring a certificate.

C. Product Test Reports: For each product, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Field quality-control reports.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials and parts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Environmental Conditions:

1. Instruments shall operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.
  - a. If instrument alone cannot meet requirement, install instrument in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated and cooled, filtered, and ventilated as required by instrument and application.



2. Instruments and accessories shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Instruments not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures. Instrument's installed location shall dictate following NEMA 250 enclosure requirements:
  - a. Indoors, Heated and Air Conditioned: Type 1.

## 2.2 AIR TEMPERATURE SENSORS

- A. UL listed.
- B. NEMA 4 & IP65 Enclosure.
- C. Power : 12 VDC. Sensor is powered from AC Unit manufacturer provided controller.
- D. Rang: 0 deg F to 126 deg F.
- E. Resistance : 61520 ohms @ 0 deg F and 6240 ohms @ 100 deg F
- F. Basis of design: Bard 8301-058 or equal.

## 2.3 AIR TEMPERATURE SWITCHES

- A. UL listed.
- B. NEMA 4 & IP65 Enclosure.
- C. Tamper resistant external setpoint adjustment.
- D. SPDT snap acting switch rated at 10A at 125/250V.
- E. Basis of design: Barksdale ML1H.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
- C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Install products level, plumb, parallel, and perpendicular with building construction.
- B. Properly support instruments, tubing, piping, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to a force.
- C. Fastening Hardware:
  - 1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
  - 2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
  - 3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.
- D. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.
- E. Corrosive Environments:
  - 1. Use products that are suitable for environment to which they are subjected.
  - 2. If possible, avoid or limit use of materials in corrosive environments.
  - 3. When conduit is in contact with a corrosive environment, use Type 316 stainless-steel conduit and fittings or conduit and fittings that are coated with a corrosive-resistant coating that is suitable for environment.
  - 4. Where instruments are located in a corrosive environment and are not corrosive resistant from manufacturer, field install products in a NEMA 250, Type 4X enclosure constructed of Type 316L stainless steel.

### 3.3 ELECTRIC POWER

- A. Furnish and install electrical power to products requiring electrical connections.
- B. Furnish and install circuit breakers. Comply with requirements in Section 16286 "Enclosed Switches and Circuit Breakers."
- C. Furnish and install power wiring. Comply with requirements in Section 16052 "Low-Voltage Electrical Power Conductors and Cables."
- D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

### 3.4 TEMPERATURE INSTRUMENT INSTALLATIONS

- A. Mounting Location:

1. Roughing In:
    - a. Outline instrument mounting locations before setting instruments and routing cable, wiring, tubing, and conduit to final location.
    - b. Provide independent inspection to confirm that proposed mounting locations comply with requirements indicated and approved submittals.
      - 1) Indicate dimensioned locations with mounting height for all surface-mounted products on Shop Drawings.
      - 2) Do not begin installation without submittal approval of mounting location.
    - c. Complete installation rough-in only after confirmation by independent inspection is complete and approval of location is documented for review by Owner and Engineer on request.
  2. Install switches and transmitters for air and liquid temperature associated with individual air-handling units and associated connected ductwork and piping near air-handling units co-located in air-handling unit system control panel to provide service personnel a single and convenient location for inspection and service.
  3. Install liquid and steam temperature switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
  4. Install air temperature switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
  5. Mount switches and transmitters on walls, floor-supported freestanding pipe stands, or floor-supported structural support frames. Use manufacturer's mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.
- B. Special Mounting Requirements:
1. Temperature instruments having performance impacted by temperature of mounting substrate shall be isolated with an insulating barrier located between instrument and substrate to eliminate effect. Where instruments requiring insulation are located in finished space, conceal insulating barrier in a cover matching the instrument cover.
- C. Mounting Height:
1. Mount temperature instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.
  2. Mount switches and transmitters located in mechanical equipment rooms and other similar space not subject to code or state and Federal accessibility requirements within a range of 42 to 72 inches above the adjacent floor, grade, or service catwalk or platform.
    - a. Make every effort to mount at 60 inches.
- D. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static-pressure class and leakage and seal classes indicated using neoprene gaskets or grommets.

E. Space Temperature Sensor Installation:

1. Conceal assembly in an electrical box of sufficient size to house sensor and transmitter, if provided.
2. Install electrical box with a faceplate to match sensor cover if sensor cover does not completely cover electrical box.
3. In finished areas, recess electrical box within wall.
4. In unfinished areas, electrical box may be surface mounted if electrical light switches are surface mounted. Use a cast-aluminum electric box for surface-mounted installations.
5. Align electrical box with other electrical devices such as visual alarms and light switches located in the vicinity to provide a neat and well-thought-out arrangement. Where possible, align in both horizontal and vertical axis.

F. Outdoor Air Temperature Sensor Installation:

1. Mount sensor in a discrete location facing north.
2. Protect installed sensor from solar radiation and other influences that could impact performance.
3. If required to have a transmitter, mount transmitter remote from sensor in an accessible and serviceable location indoors.

G. Single-Point Duct Temperature Sensor Installation:

1. Install single-point-type, duct-mounted, supply- and return-air temperature sensors. Install sensors in ducts with sensitive portion of the element installed in center of duct cross section and located to sense near average temperature. Do not exceed 24 inches in sensor length.
2. Install return-air sensor in location that senses return-air temperature without influence from outdoor or mixed air.
3. Rigidly support sensor to duct and seal penetration airtight.
4. If required to have transmitter, mount transmitter remote from sensor at accessible and serviceable location.

H. Averaging Duct Temperature Sensor Installation:

1. Install averaging-type air temperature sensor for temperature sensors located within air-handling units, similar equipment, and large ducts with air tunnel cross-sectional area of 20 sq. ft. and larger.
2. Install sensor length to maintain coverage over entire cross-sectional area. Install multiple sensors where required to maintain the minimum coverage.
3. Fasten and support sensor with manufacturer-furnished clips to keep sensor taut throughout entire length.
4. If required to have transmitter, mount transmitter in an accessible and serviceable location.

I. Low-Limit Air Temperature Switch Installation:

1. Install multiple low-limit switches to maintain coverage over entire cross-sectional area of air tunnel.
2. Fasten and support sensing element with manufacturer-furnished clips to keep element taut throughout entire length.

3. Mount switches outside of airstream at a location and mounting height to provide easy access for switch set-point adjustment and manual reset.
4. Install on entering side of cooling coil unless otherwise indicated on Drawings.

### 3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 16070 "Identification for Electrical Systems."

### 3.6 CLEANING

- A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.
- B. Wash and shine glazing.
- C. Polish glossy surfaces to a clean shine.

### 3.7 CHECK-OUT PROCEDURES

- A. Check installed products before continuity tests, leak tests, and calibration.
- B. Check temperature instruments for proper location and accessibility.
- C. Verify sensing element type and proper material.
- D. Verify location and length.
- E. Verify that wiring is correct and secure.

### 3.8 ADJUSTMENT, CALIBRATION, AND TESTING

- A. Description:
  1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
  2. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.
  3. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.
  4. Equipment and procedures used for calibration shall meet instrument manufacturer's written instructions.
  5. Provide diagnostic and test equipment for calibration and adjustment.
  6. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. For example, an

installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.

7. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
8. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.
9. Comply with field-testing requirements and procedures indicated by ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements and to supplement requirements indicated.

B. Analog Signals:

1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistance source.

C. Digital Signals:

1. Check digital signals using a jumper wire.
2. Check digital signals using an ohmmeter to test for contact.

D. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

E. Switches: Calibrate switches to make or break contact at set points indicated.

F. Transmitters:

1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

### 3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform according to manufacturer's written instruction.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

### 3.10 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

### 3.11 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include annual preventive maintenance, repair or replacement of worn or defective components, cleaning and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

### 3.12 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain temperature instruments.
- B. Provide a complete set of instructional videos covering each product specified and installed and showing the following:
  - 1. Software programming.
  - 2. Calibration and test procedures.
  - 3. Operation and maintenance requirements and procedures.
  - 4. Troubleshooting procedures.
- C. Coordinate video with operation and maintenance manuals and classroom instruction for use by Owner in operating, maintaining, and troubleshooting.
- D. Record videos on DVD disks.
- E. Owner shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 15935

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## SECTION 16011 - FACILITY PERFORMANCE REQUIREMENTS FOR ELECTRICAL

### 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. Field conditions and other facility performance requirements applicable to Work specified in Division 16.

#### 1.3 FIELD CONDITIONS

- A. Altitude:

- 1. Sea level to 400 feet.

- B. Ambient Temperature:

- 1. 110 degrees F.

- C. Temperature Variation: Allow for thermal movements from the following differential temperatures:

- 1. Outdoor Ambient Temperature Differential: 120 degrees F.
- 2. Material Surface Temperature Differential: 180 degrees F.

- D. Hazardous and / or Corrosive Environmental Conditions: As indicated on the Drawings.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION (Not Used)

END OF SECTION 16011

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## SECTION 16050 – LIMITED ELECTRICAL FOR SMALL PROJECTS

### 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. Copper power and control wire rated 600V or less.
2. Low-voltage instrumentation cable.
3. Industrial Ethernet cable.
4. Connectors, splices, and terminations.
5. Grounding and bonding components.
6. Support systems for raceways, boxes, and electrical equipment.
7. Metal conduits and fittings.
8. Nonmetallic conduit and fittings.
9. Boxes, enclosures, and cabinets.
10. Identification requirements.

#### 1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit. See also RAC.
- B. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.
- C. Duct: A single duct or multiple ducts. Duct may be installed singly or as a component of a duct bank.
- D. Duct Bank:
  1. Two or more ducts installed in parallel, with or without additional casing materials.
  2. Multiple duct banks.
- E. EMI: Electromagnetic interference.
- F. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50V or for remote-control and signaling power-limited circuits.
- G. RAC: Rigid aluminum conduit. See also ARC.
- H. RoHS: Restriction of Hazardous Substances.

- I. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.
- J. National Electrical Code (NEC) / NFPA conduit types:
  - 1. RMC – rigid metal conduit
  - 2. FMC – flexible metal conduit
  - 3. LFMC – liquidtight flexible metal conduit
  - 4. PVC – rigid polyvinyl chloride conduit
  - 5. LFNC – liquidtight flexible nonmetallic conduit
  - 6. RNC – rigid nonmetallic conduit
  - 7. EMT – Electrical metallic tubing
- K. ACTION SUBMITTALS Product Data: For each type of product used on this project.
- L. Shop Drawings:
  - 1. Precast Handholes: Include plans, elevations, sections, and details.
- M. Installation Working Drawings: For underground conduit routing.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 ELECTRICAL MATERIALS

- A. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with associated UL Standards as applicable and listed in this specification.

#### 2.2 WIRE

- 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. Alpha Wire Company.
  - 2. Encore Wire Corporations.
  - 3. General Cable Technologies Corporation.
  - 4. Okonite Company (The).
  - 5. Service Wire Co.
  - 6. Southwire Company.
- B. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V.

- C. Standards:
  - 1. RoHS compliant.
  - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Size: Minimum No. 12 AWG for power circuits, minimum No. 14 AWG for control circuits.
- F. Stranding: Refer to Part 3 "Conductor Applications" Article.
- G. Conductor Insulation: Refer to Part 3 "Conductor Applications" Article.
  - 1. Type RHW-2: Comply with UL 44.
  - 2. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
  - 3. Type THHN and Type THWN-2: Comply with UL 83.
  - 4. Type XHHW-2: Comply with UL 44.

## 2.3 INSTRUMENTATION CABLE

- 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. Belden.
  - 2. Rockbestos.
- B. Single of Multiple Paired Cable: NEC type ITC (Instrumentation Tray Cable), UL Type TC for 4-20mA process instrumentation signals and use under NEC Article 72.
  - 1. One or Multi-pair, twisted, shielded, No. 16 AWG, stranded (19x29) tinned-copper conductors.
  - 2. XLPE insulation, 600V.
  - 3. Shield: 100 percent aluminum/polyester foil with drain wire. Pairs individually shielded.
  - 4. PVC jacket with manufacturer's identification.
  - 5. Standards: UL 1277 Type TC, UL 1581

## 2.4 INDUSTRIAL ETHERNET CABLE

- 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. Rockwell Automation 1585-C8HB-S.
- B. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 5e cable at frequencies up to 100 MHz *Ethernet/IP* compliant.
- C. Standard: UL, UL PLTC, UL AWM 2570 80C 600V, TIA 568B.

- D. Conductors: 100-ohm, No. 22 AWG solid copper.
- E. Shielding/Screening: Overall foil shield.
- F. Cable Rating: 600V.
- G. Jacket: PVC.

## 2.5 CONNECTORS, SPLICES, AND 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 Electrical Products.
  - 2. Ideal Industries, Inc.
  - 3. TE Connectivity Ltd.
  - 4. Thomas & Betts Corporation; A Member of the ABB Group.
- B. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
  - 1. Material: Tin-plated copper.
  - 2. Type:
    - a. Locking spade with insulated sleeve for No. 10 AWG and smaller.
    - b. One hole with long barrels for No. 8 AWG to No. 4/0 AWG.
    - c. Two holes with long barrels for 250 kcmil and larger.
  - 3. Termination: Compression for No. 8 AWG and larger.
- D. Connectors:
  - 1. Solderless pressure type (wirenuts) for No. 10 AWG and smaller.
  - 2. Pre-filled with silicone-based sealant for exterior, wet, or corrosive locations.
  - 3. Split bolt type for No. 8 AWG and larger splices.
- E. Motor Terminations: Mechanical compression ring type, secured with bolt, nut, and spring washer. Insulated with Raychem type RVC, roll-on stub insulator or equal.
- F. Industrial Ethernet Cable Terminations: Match conductor count, RJ45 type, intended for shielded cable. Rockwell Automation Bulletin 1585J or equal.

## 2.6 GROUNDING AND BONDING 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. ERICO; a brand of nVent.
  2. Hubbell Incorporated (Construction and Energy Group).
  3. O-Z/Gedney; a brand of Emerson Industrial Automation.
  4. Thomas & Betts Corporation; A Member of the ABB Group.
- B. Standard: Comply with UL 467 for grounding and bonding materials and equipment.
- C. Grounding Conductors:
1. Insulated conductors to match corresponding 600V phase conductor insulation requirements.
- D. Ground rods: Copper-clad steel, sectional type; 3/4-inch diameter by 10-foot; minimum copper thickness 0.25 mm (10 mil).
- E. Grounding conduit hubs: Malleable iron type, mechanical type, terminal with threaded hub, sized for the associated conduit.
- F. Waterpipe ground clamps: cast bronze saddle type, sized for the associated water pipe.
- G. Exothermic weld: CADWELD process, or equal. Molds and powder furnished by same manufacturer and selected for specific combination of conductors and connected items. Use low emission type, CADWELD EXOLON or equal for welds used indoors in occupied buildings or confined spaces.

## 2.7 SUPPORT SYSTEMS

- A. Aluminum Channel:
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  2. Channel Material: 6063-T5 aluminum alloy.
  3. Fittings and Accessories Material: 5052-H32 aluminum alloy.
- B. Stainless Steel Channel:
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  2. Material for Channel, Fittings, and Accessories: Stainless steel, Type 316.
- C. Hot-dipped Galvanized Steel Channel:
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  2. Material for Channel, Fittings, and Accessories: Hot-dipped galvanized steel.
- D. Nonmetallic Channel:
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  2. Channel Material: Ultraviolet resistant FRP.
  3. Fittings and Accessories Material: Stainless steel, Type 316 or compatible non-metallic.

- E. Accessories: conduit clamps, straps, hangers, rods, backplates, anchors, nuts, washers, etc. shall match channel material as listed in the SUPPORT MATERIALS APPLICATION Article. Use of galvanized steel components is only allow with galvanized steel channel.
- F. Threaded rod: 3/8-inch minimum diameter.
- G. Expansion anchors: 3/8-inch minimum diameter.

## 2.8 METAL CONDUITS AND FITTINGS

- A. Rigid Aluminum Conduit: Comply with ANSI C80.5 and UL 6A.
- B. EMT: Comply with ANSI C80.3 and UL 797.
- C. LFMC: Sealtite®, Type UA, continuously interlocked flexible steel conduit with sunlight and chemical resistant PVC jacket and complying with UL 360.
- D. FMC: Comply with UL 1; zinc-coated steel.
- E. Metallic Fittings: Comply with NEMA FB 1 and UL 514B.
  - 1. Use cast aluminum fittings with RAC.
  - 2. Use malleable iron, three-piece screw in type with LMFC.
  - 3. Use Myers Electric Products, Inc. or equal, grounding type for conduit hubs.
  - 4. Use die cast compression type fittings with EMT, no set-screw type.

## 2.9 NONMETALLIC CONDUIT AND FITTINGS

- A. RNC: Schedule 40 or Schedule 80 PVC based on application; comply with NEMA TC 2 and UL 651.
- B. LFNC-B: Comply with UL 1660, Type B.
- C. Nonmetallic Fittings:
  - 1. RNC: Comply with NEMA TC 3; match conduit type and material.
  - 2. LFNC: Comply with UL 514B; dust-tight, liquid-tight, chemical resistant thermoplastic/nylon construction with tapered thread hub and neoprene O-ring gasket. Push-on fittings are prohibited.
- D. Solvents and Adhesives: As recommended by conduit manufacturer.

## 2.10 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: Pressed steel. Comply with NEMA OS 1 and UL 514A.
- B. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.



- C. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- D. NEMA 1 and NEMA 12 Pull and Junction Boxes:
  - 1. Material: Sheet steel, minimum 14 gauge, without knockouts.
  - 2. Construction: flanged box, galvanized with continuous weld seams that are ground smooth.
  - 3. Cover: Gasketed, hanged, fastened with quick connect door clamp.
- E. NEMA 4X Pull and Junction Boxes:
  - 1. Material: Type 316 stainless steel, minimum 14 gauge, without knockouts.
  - 2. Construction: flanged box, continuous weld seams that are ground smooth.
  - 3. Cover: Gasketed, hanged, fastened with quick connect door clamp.
- F. NEMA 4X Chemical Area Pull and Junction Boxes: When Drawings classify the area as CORROSIVE, ultraviolet resistant fiberglass reinforced plastic (FRP) with 316 stainless steel hardware and gasketed covers.
- G. NEMA 7/4 Pull and Junction Boxes: When Drawings classify the area for Class 1, Division 1, Group D hazardous area, cast aluminum with stainless steel bolts; Type EJB-N4 as manufactured by Crouse Hinds or equal.

## 2.11 IDENTIFICATION

- A. Factory applied insulation color for No. 8 AWG conductors and smaller. Factory applied insulation color or field applied colored electrical tape for No. 6 AWG conductors and larger:
  - 1. Color for 208/120V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
    - d. Neutral: White.
  - 2. Color for 240/120V Circuits (Single Phase):
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Neutral: White.
  - 3. Color for 240 $\Delta$ /120V Circuits (Three Phase, Four Wire, high leg, center tap):
    - a. Phase A: Black.
    - b. Phase B: Orange (high leg).
    - c. Phase C: Blue.  
Neutral: White.
  - 4. Color for 480/277V Circuits:
    - a. Phase A: Brown.

- b. Phase B: Orange.
    - c. Phase C: Yellow.
    - d. Neutral: Gray.
  - 5. Color for Equipment Grounds: Green.
  - 6. Color of Individual Control Conductors:
    - a. AC: Red.
    - b. DC: Blue.
- B. Nameplates and Labels:
- 1. Equipment Identification and Source Nameplates:
    - a. Black letters on a white field.
    - b. Engraved, laminated plastic, 3/16-inch-high lettering.
    - c. Provide for all electrical equipment. Match Drawing designation.
    - d. Include power source information, i.e., "FED FROM MCC-2" or provide separate nameplate.
  - 2. Device Identification Labels:
    - a. Black letters on a white field.
    - b. Machine generated, self-adhesive, 1/4-inch-high lettering.
    - c. Provide for all receptacles, wall switching, lighting fixtures, photocells, exit lights, instruments, etc.
    - d. Include power source and branch circuit information, i.e., "LP-2/15" indicates panelboard LP-2, branch circuit 15.
  - 3. Wire and Cable Labels:
    - a. Black letters on a white field.
    - b. Wraparound or sleeve type.
- C. Detectable Underground-Line Warning Tape:
- 1. Foil-backed, detectable buried utility tape with black lettering on a bright background.
  - 2. Width: 6 inches.
  - 3. Overall Thickness: 5 mils.
  - 4. Background Color / Description:
    - a. Red / Electric: electrical power, control, or instrumentation.
    - b. Orange / Fiber: fiber optic cables.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Comply with the applicable National Electrical Contractors Association (NECA) documents for installation requirements except where requirement on Drawings or in this specification are stricter.
  - 1. NECA 1: Standard for Good Workmanship in Electrical Construction.
  - 2. NECA 101: Standard for Installing Steel Conduits.
  - 3. NECA 102: Standard for Installing Aluminum Rigid Metal Conduit.
  - 4. NECA 111: Standard for Installing Nonmetallic Raceways.
  - 5. NECA 331: Standard for Installing Building and Service Entrance Grounding and Bonding.
  - 6. NECA / NEMA 605: Recommended Practice for Installing Underground Nonmetallic Utility Duct.

### 3.2 CONDUCTOR APPLICATIONS

- A. Wires and Cables: Copper, stranded, except for lighting and receptacle wiring which may be solid.
- B. Wire for lighting, receptacles, and other circuits not exceeding 150 volts to ground shall be NEC type XHHW-2. Below grade and underground the wire shall be type XHHW-2.
- C. Wire for power circuits over 150 volts to ground shall be NEC type XHHW-2 for sizes No. 4/0 AWG and smaller, and shall be NEC type RHW-2 for sizes 250 kcmil and larger.
- D. Equipment grounding conductors shall be the same NEC type as the phase conductors described previously, green and sized per NEC Table 250.122.
- E. Bare copper ground wire shall be stranded, soft drawn annealed copper wire.
- F. Ground grid conductors shall be uninsulated unless shown otherwise on the Drawings.
- G. Wire for control, status, and alarm shall be NEC type XHHW-2.
- H. Multi-conductor power cable shall be stranded, 600V, cross-linked polyethylene insulated with PVC jacket, Type TC (XLP) with ground.
- I. Multi-conductor control cable shall be NEC type TC (tray cable), stranded, No. 14 AWG, XHHW-2 600V insulated color coded conductors, bare stranded ground wire, with overall PVC cable jacket.

### 3.3 CONDUCTOR INSTALLATION

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

- B. Complete raceway installation between conductor and cable termination points 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. Use of steel fish tapes and/or steel pulling cables in PVC conduit or raceways that terminate into energized enclosures is prohibited.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Adequately support cables.
- G. 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.
- H. 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. Do not splice service or feeder cables without prior written approval of Engineer. Instrumentation and Ethernet cables may not be spliced and shall be continuous from terminal to terminal.
- I. Wiring at Outlets:
  - 1. Install conductor at each outlet, with at least 6 inches of slack.
  - 2. Form solid wire into loop to fit around device terminal screw. Do not overlap wire.
- J. Identify and color-code conductors and cables.
- K. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.
- L. Identify circuit number associated with lights, receptacles, and other miscellaneous loads to panelboards. Identify phase and neutral conductors with circuit number.
- M. Install instrumentation and Ethernet cabling in separate raceway from control or power wiring.
- N. Separation from EMI Sources:
  - 1. Separation between open instrumentation cables or cables in non-metallic or non-ferrous raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Equipment or circuits rated less than 2 kVA: Minimum 5 inches.
    - b. Equipment or circuits rated between 2 and 5 kVA: Minimum 12 inches.
    - c. Equipment or circuits rated more than 5 kVA: Minimum 24 inches.

### 3.4 GROUNDING

- A. Comply with NEC Article 250.
- B. Install insulated green equipment grounding conductor in all power and control raceways.
- C. For instrumentation wiring, ground shield at one end only as recommended by instrument manufacturer and in accordance with Owner's standard.
- D. Install grounding conductors in conduit or sleeves when passing through floor slabs.
- E. Use exothermic welding process for all underground connections, connections to structural steel, connections to ground rods, or other connections which will become inaccessible at project completion.

### 3.5 SUPPORT MATERIALS APPLICATION

- A. Dry, indoor, conditioned, non-process space: Hot-dipped galvanized steel.
- B. Outdoor, process areas, or areas shown on the drawings as "DUST", "DAMP", or "WET": Aluminum and/or stainless-steel channel, depending upon load requirements.
- C. Areas shown on the drawings as "CORROSIVE": Nonmetallic.

### 3.6 RACEWAY APPLICATIONS

- A. Refer to Appendix Table 16050-1 for specific raceway application requirements.
- B. Minimum Raceway Size: 3/4-inch trade size.

### 3.7 BOX APPLICATIONS

- A. All boxes shall be metallic unless specified herein or indicated on the Drawings.
- B. Use cast malleable iron for boxes and conduit fittings for exposed switch, receptacle, and lighting outlets.
- C. Use pressed steel boxes for concealed switch, receptacles, and lighting outlets.
- D. Pull boxes, junction boxes, cabinets, etc. shall be suitable for the location and conform to the NEMA enclosure rating and material descriptions as indicated on the Drawings.
- E. Where no size is indicated for junction boxes, pull boxes, or terminal cabinets, size in accordance with NEC Article 314.

### 3.8 RACEWAY INSTALLATIONS

- A. Complete raceway installation before starting conductor installation.

- B. Tightly plug ends of conduits during construction to exclude dust and moisture.
- C. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- D. Arrange conduit system to allow liquids such as water, condensation, etc. will drain away from equipment served. If conduit drainage is not possible, plug conduits using conduit seals.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run. Support within 12 inches of changes in direction.
- F. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- G. Support conduit within 12 inches of enclosures to which attached.
- H. 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.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- J. 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. Install Meyers grounding type hubs when conduits terminate at gasketed enclosures.
- K. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- L. 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.
- M. 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.
- N. 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.
- O. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- P. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways using "Duxseal" or seal fitting at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where an underground service raceway enters a building or structure.
  3. Conduit extending from interior to exterior of building.
  4. Conduit extending into pressurized duct and equipment.
  5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
  6. Where otherwise required by NFPA 70.
- Q. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- R. Install expansion joint fittings where necessary to compensate for thermal expansion and contraction.
- S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission or movement; and for transformers and motors.
- T. 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 center of box unless otherwise indicated.
- U. A maximum continuous run of conduit shall not exceed 300 feet and shall be reduced by 75 feet for each 90-degree elbow.
- V. Provide a 4-inch concrete housekeeping pad at all slab and grade penetrations. Provide a 45 degree, 3/4-inch chamfer at all exposed edges.
- W. Protect metallic finish conduit installed in contact with concrete or below grade with two coats of bitumastic paint, heat shrink tubing, or approved equivalent. Extend protection on riser conduits from 12 inches below slab to 6 inches above slab.
- X. In hazardous locations, seal conduits terminating at boxes enclosing circuit opening equipment at the entrance to the enclosure with approved compound filled sealing fittings to prevent passage of explosive or combustible gases through the conduits. Similarly seal all conduits leading from or entering hazardous locations at points of exit or entrance. Seal exposed conduits passing through hazardous locations at both the entrance to and the exit from the hazardous locations.
- Y. Install conduit sealing and drain fittings in all hazardous (classified) areas designated Class 1, Division 1, and Class 1, Division 2.
- 3.9 ELECTRICAL PENETRATIONS
- A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc.
- B. Locate all slots and concealed conduits and stub-ups for electrical work and place and form as required before concrete is poured.
- C. Make weathertight and restore finishes on exterior penetrations.

- D. Use conduit wall seals where underground conduits penetrate walls or at other locations indicated on the Drawings.
- E. Seal openings where conduits pass through walls or floors to prevent passage of flame and smoke. Maintain fire rating of walls.
- F. Patch and paint interior wall penetrations to match original.

### 3.10 IDENTIFICATION INSTALLATION

- A. Self-Adhesive Identification Products: Before applying identification product, prepare and clean attachment surface with manufacturer recommended product to allow for effective bond.
- B. Verify and coordinate identification names and other features.
- C. Nameplate Attachment:
  - 1. Screw mounted for NEMA 1 enclosures.
  - 2. Epoxy or similar waterproof adhesive for all other enclosure types.
- D. Install identification and power source nameplates for electrical equipment. Refer to Part 2 “Identification” Article for requirements.
- E. Install circuit identification labels for cables and conductors at each termination location and within pull boxes and handholes. Refer to PART 2 “Identification” Article for color code and additional requirements.
- F. Install device identification labels for receptacles, light switches, etc. Refer to Part 2 “Identification” Article for requirements.
- G. Install underground warning tape during backfilling of trenches for underground conduits and duct banks in accordance with details on the Drawings.
- H. Panelboard Identification
  - 1. Provide equipment and power source nameplates as previously described.
  - 2. Label branch circuit phase and neutral wires with associated pole number.
  - 3. Install typed as built circuit directory giving location and nature of load served.

### 3.11 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections for conductors and cables.
  - 1. Visually inspect for correct installation.
  - 2. Perform continuity test.
  - 3. Perform insulation-resistance test for power and control conductors in accordance with NETA standards.
  - 4. Verify uniform resistance of parallel conductors.
- B. Cable will be considered defective if it does not pass tests and inspections.



- C. Conduct fall-of-potential grounding electrode system test in accordance with IEEE 81.
- D. Prepare test and inspection reports.

3.12 CLEANING / PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration. Repair damage as recommended by manufacturer.
- B. Remove all rubbish and construction debris from inside electrical equipment and enclosures.

3.13 APPENDICES

- A. Table 16050-1: Raceway Application Guidelines

Table 16050-1 Raceway Application Guidelines	
Raceway Type	Location / Application
Aluminum Rigid Conduit (ARC)	All indoor and outdoor applications, except where other types are listed. All exposed, non-corrosive areas.  Use LFMC for flexible connections.  When installed underground or in contact with concrete, paint with two coats of bitumastic paint.
PVC Schedule 40	Embedded in concrete slabs or structures.  Use ARC elbows.
PVC Schedule 80	Corrosive areas. Protection of grounding electrode conductors. Protection of lightning conductors.  Where exposed, use LFNC for flexible connections.  Use ARC elbows for underground applications.

END OF SECTION 16050

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